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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

1932 XIII

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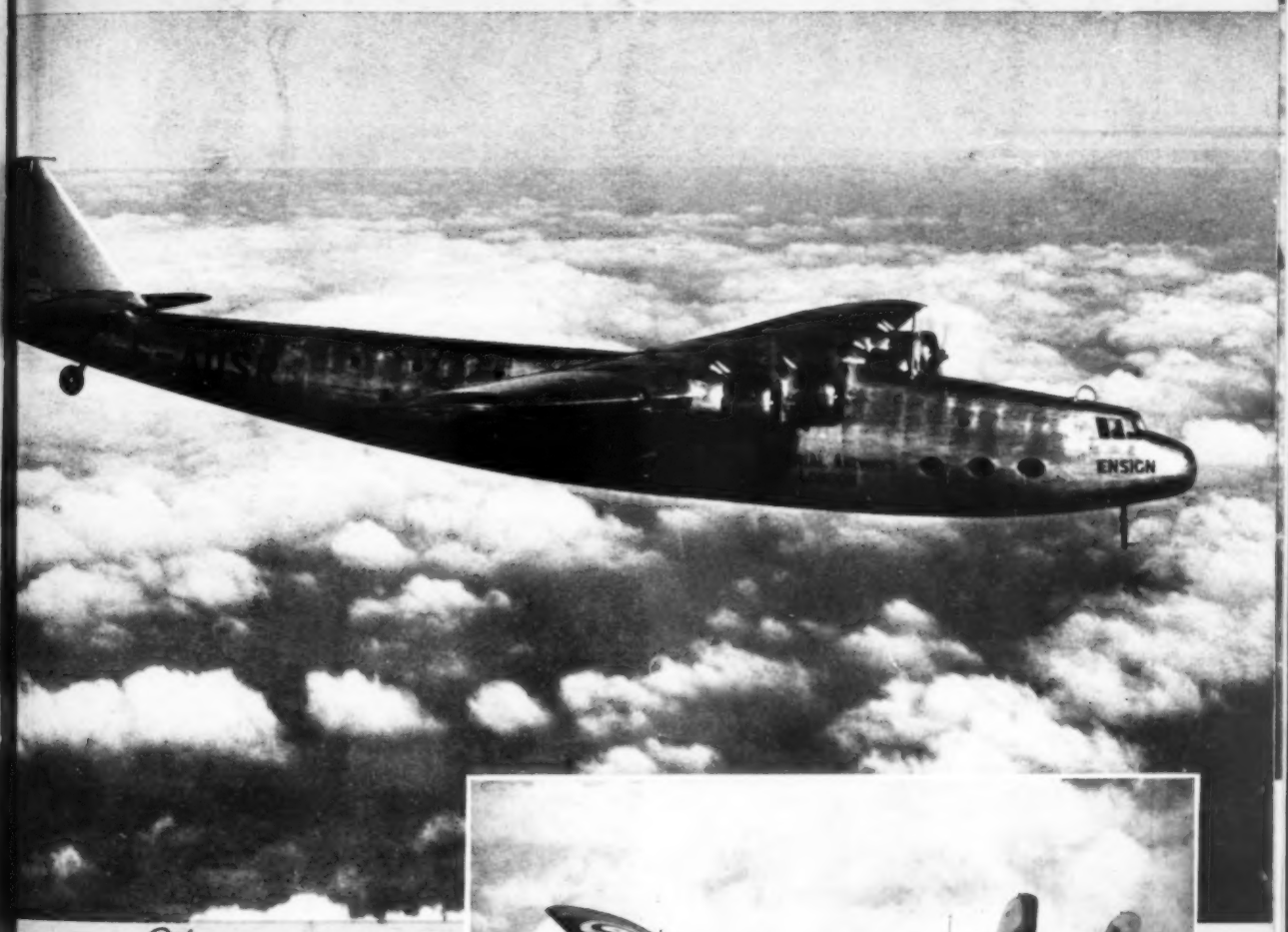

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

Revolt

ALTHOUGH the recent statement by the Provost of Renfrew that Glasgow's Airport would be closed was itself (until the partial recantation) serious enough, far more serious is the definite discontent and the criticism of Air Ministry methods of which this was merely a single publicly voiced sign. At least two other municipalities have been seriously considering the closing of their aerodromes.

Apparently the Renfrew Town Council had reason enough for complaining of discourtesy and procrastination, but it is hard to believe that this matter of traffic control arrangements was the real reason for such a sudden move. It seems to be more likely to be that this Town Council in particular, as well as many others in the country, was and is desperately disappointed with the Cadman Committee recommendations and the Government's rejoinder thereto on the matter of airport assistance. The Councils feel, not unnaturally, that the provision of aerodromes is a national service and that the Government should do rather more to help them than by the mere provision of traffic control and operational facilities.

Unfortunately, the Renfrew affair seems to be mixed up with a very much bigger issue and the general opinion in air transport circles is that some form of explosion is about to occur. Be that as it may, Glasgow cannot be allowed to lose its terminal.

If things continue as they are at present we shall, in due course, have only one internal airline—operated by K.L.M. —and half a dozen public aerodromes run by really dauntless enthusiasts.

The European Services

THERE appears to be some misunderstanding in Air Ministry circles about the actual recommendations of the Cadman Committee and particularly about those in relation to the European services. Since the publication of the Committee's report it seems to have been generally considered that two companies, and only two companies, would be eligible for financial assistance on European routes and that British Airways in particular would be the appointed company to operate the greater number of them.

In fact, the Cadman Committee merely considered "that national prestige and the interests of British civil aviation require that first-class air services, financially assisted by the State as necessary, should be established between London and all the principal capitals of Europe." There was nothing in the Report to suggest that there should necessarily be *only* two operating companies receiving a subsidy. All that was said was that external air services "must be concentrated in a small number of well-founded and substantial organisations rather than dissipated among a large number of competing companies of indifferent stability."

The matter has been brought into prominence in the first place by the question asked by the Marquis of Clydesdale in the House on March 28 concerning the eligibility of Allied Airways for a subsidy for their Norwegian Service, and by the recent requests which have been made by Alp Air Line, a subsidiary of North Eastern Airways, for a share of the available subsidy for the purpose of operating a service to Switzerland. In the first case, Lt.-Col. Muirhead made it clear that the whole question of European services was being reconsidered, but would give no assurance to the questioner.

Probably the Air Ministry has very good reasons for its non-committal attitude in such cases, but, if so, the reasons should be stated, and it is obviously poor logic to point to the Cadman Committee recommendations, which most certainly did not suggest that no companies other than Imperial Airways and British Airways should be eligible for assistance.

The Real Issue

SO far as the general travelling public is concerned, their interest is not with the rights and wrongs of such matters, but with the organisation of transport companies so that the best possible services shall be run by British operators throughout Europe and elsewhere. Whether or not British Airways will, in fact, take over the entire European system when Imperial Airways' contract expires next year remains to be seen, but it is at least obvious that neither of the companies is at present capable of doing justice single-handed to a European service network. Imperial Airways are busy with the Empire and other services outside Europe, and British Airways have

the West African and South Atlantic service to be developed.

It is only reasonable, in the circumstances, that, if necessary, other "well-founded" companies should be encouraged to run certain European services. In due course, all the companies concerned could usefully be amalgamated. In the meantime the public requires that the services be run. By whom, provided that the companies concerned are "well-founded," is a matter of little importance to them.

When speaking of available equipment it may loosely be suggested that Imperial Airways should hand over a very fair proportion of their ordered fleet of Ensigns and Albatrosses. They may; but having, so to speak, had Europe taken away from them, it could be a little irritating for Imperial Airways to be told that they must also hand over their new fleet. Probably they will refuse to do so and a triangular war between the Air Ministry, Imperial Airways and British Airways will have started in earnest. Its results will not be such as to increase our civil flying prestige abroad.

L for Leather?

THAT the R.A.F. expansion scheme known as "Scheme F," which aimed at 1,750 first-line aircraft by March, 1939, is now regarded as inadequate was more or less hinted at by the Prime Minister in the House of Commons on March 24, when, in the course of his speech on foreign affairs and rearmament, he said: "We have now come to the conclusion that in the present circumstances acceleration of existing plans has become essential, and, moreover, that there must be an increase in some parts of the programme, especially in that of the Royal Air Force and the anti-aircraft defences." Subsequent events, and statements in the House and elsewhere, have made it clear that it is the intention of the Government to go very far beyond the plans of "Scheme F," not merely in acceleration but in magnitude.

The House will have an opportunity this week of eliciting such further information on the subject as the Government may think fit to disclose, although doubtless good use will be made of the time-honoured phrase, "It is not in the public interest." In the meantime the appointment of an inter-departmental committee under the chairmanship of Lord Winterton is significant. On this committee are represented the directorates of Research and Development, Supply and Organisation, and Operations and Intelligence of the Air Ministry, and the new chairman of the S.B.A.C. is a member.

It is expected that Lord Winterton will explain, during this week's debate, that the sending of the mission to America to study the possibility of American supplies for the R.A.F. is connected with the new expansion scheme, known as "Scheme L," and that it does not indicate deficiencies in the older "Scheme F," which is considered reasonably up to schedule.

If that is, indeed, the case, it is not a little surprising that the Society of British Aircraft Constructors was not consulted before the mission left for America. Yet apparently the first intimation the S.B.A.C. had was the statements published in the daily Press!

No Magic Wand

LAST week we commented on some of the difficulties connected with buying aircraft in America. In this issue we publish an article which deals in greater detail with the possible consequences of ordering American aircraft. The writer comes to very much the same conclusions as those reached by us, and points out that considerable delays are bound to occur, even granting that the American aircraft industry is capable of that expansion of output which our placing of orders would presuppose.

There seems to be one way, and one way only, in which America could help to accelerate the re-equipment of the R.A.F.—that the U.S. Army and Navy Air Corps should agree to forgo their deliveries in favour of the R.A.F. However, that supposition is so fantastic that it may be ruled out straight away.

It is remarkable how a childlike belief has grown up in this country that the American aircraft industry has found the magic wand of mass production. It does not seem to be generally realised that last year the American firms fell short of what was, after all, a very modest output compared with what we are visualising in this country for the R.A.F. That fact does not appear to hold out much promise of huge deliveries to this country, even if the mission should return with a recommendation that orders be placed.

When it comes to Canada the position is entirely different, as we pointed out last week. It is entirely logical, and good sound sense, that Canadian firms should be included in our greater expansion scheme. But that should not, and cannot, be on a basis of panic expansion. It must

TUG O'WAR: In preparation for her trials this month, *H.M.S Ark Royal* is taken to the dry dock on the Liverpool side of the Mersey for the fitting of propellers and for repainting below the water line. She was launched at Birkenhead on April 12 last year. Sister ships to the *Ark Royal*, *Illustrious* and *Victorious*, are now on the stocks.

EMPIRE EXHIBITION: A fine aerial view of Bellahcuston Park, Glasgow, opened by His Majesty the King last Tuesday. As recorded elsewhere in this issue, there are several items of outstanding aerial interest.

of necessity be planned as a long-range arrangement whereby immediate deliveries in large quantities are not expected, but a steady flow spread over a period of several years. In fact, a very good case could be made out for establishing permanent factories in Canada, where production could proceed unhampered by fear of air raids.

It must be left to the British aircraft industry to attend to the urgent needs of the immediate future, a task which it can quite well fulfil if properly organised and if given a freer hand in running its own production. But Canada could, and should, play its part in providing some of the large stocks of reserves which will be necessary.

Towed Gliding

As recorded in *Flight* last week, the Easter Week gliding meetings in this country produced some outstanding long-distance performances. A sailplane pilot who took part in one of the events tells us that the weather was very good, but not as outstanding as would be thought from the results, and the pilots are only beginning to get back on cross-country form from the winter's hill soaring. The cause must be something else, something which is just beginning to come into its own in this country, and with which these fine flights can be directly connected, and that is aero-towing. This is a method of launching which allows the sailplane to be taken to regions of lift, and obviates the necessity of finding a hill which faces the right way—a matter which is becoming increasingly difficult as more and more people decide that they want to go and live in the wide open spaces.

This Easter the first meeting in England to have aero-towed launching only was held at Mr. Lindsay Everard's private aerodrome at Ratcliffe, and the Cambridge Gliding Club's camp at Huish, where the other half of the London Gliding Club went, also had aero-towing, and it is significant that every one of the above flights, as well as the many others of over 60 miles, were started by aeroplane. All the sailplanes were towed up to 2,000ft. only, where they released the cable and set off to search for thermal and cloud lift.

The usefulness of aero-towing has only lately been fully realised, but now it is possible to get a tow at Heston at any time. The Yorkshire and Cambridge clubs have towing aeroplanes available, and Air Publicity have an Avro 504N which does the towing for the London Club.

If full use is made of these facilities, this year should produce several more records and bring us a little nearer the distances reached by the Germans and Russians, as it will be possible to fly farther before reaching the sea, which means the end of every sailplane's flight, unless the Channel is crossed, as it probably soon will be.

Forthcoming Events

May 8. R.Ae.S. Garden Party, Great West Aerodrome.
May 14-22. Finnish Aero Show, Helsinki.
May 17. Air League of the British Empire: Annual Dinner, Grosvenor House, London.
May 17. Aero Golfing Society: "Flight" Trophy, Royal Ashdown Forest.
May 28. Air League of the British Empire: Empire Air Day.
June 4-6. Manx Air Races.
June 11. Bristol and Wessex Aeroplane Club: Garden Party.
June 18 and 19. Brooklands Four-club "At Home."
June 22-28. F.A.I. Conference, Berlin.
June 25. Official opening of Wolverhampton Airport.
June 25-July 1. Magyar Pilota Picnic, Budapest.
June 30. Aero Golfing Society: Jubilee Cup, Prince's, Sandwich.
July 2. R.Ae.C.: King's Cup Race.
July 9. Ipswich Aero Club: Flying Meeting.
July 9-17. National Gliding Contests, Dunstable.
July 16-18. Deauville Rally.
July 16. Official opening of Luton Municipal Aerodrome by Secretary of State for Air.
July 17-24. Third Littorio Rally, Italy.
July 23. County Flying Club: Flying Meeting at Rearsby, Leicester.

In the news : The Boeing XB-15 bomber, which the newspapers delight in calling "the flying fortress." At present it has four 1,000-1,100 h.p. P. and W. Twin Wasps.

Some Considered Opinions on the Possible Outcome of the British Commission's Visit

By PRODUCTION ENGINEER

EXAMINATION of the constitution of the British Commission which has gone to the United States to investigate the possibilities of military aircraft purchase makes it fairly evident that their powers are limited. For instance, it looks as though they may select suitable types, carry out some test flying and discuss possible terms of purchase—nothing more. In other words, they have not gone with an open order in their pockets, but will report on their return; and orders, if any, will not be placed by the Air Ministry until the Commission's report has been examined.

If the order is for a thousand bombers, the total value will be anything between thirty and fifty million pounds, and may be more if ample provision is made for spares. Probably the Commission has also been asked to report as to whether the aircraft should be purchased complete with American engines, instruments, armament, or whether the machines can be altered to take British equipment.

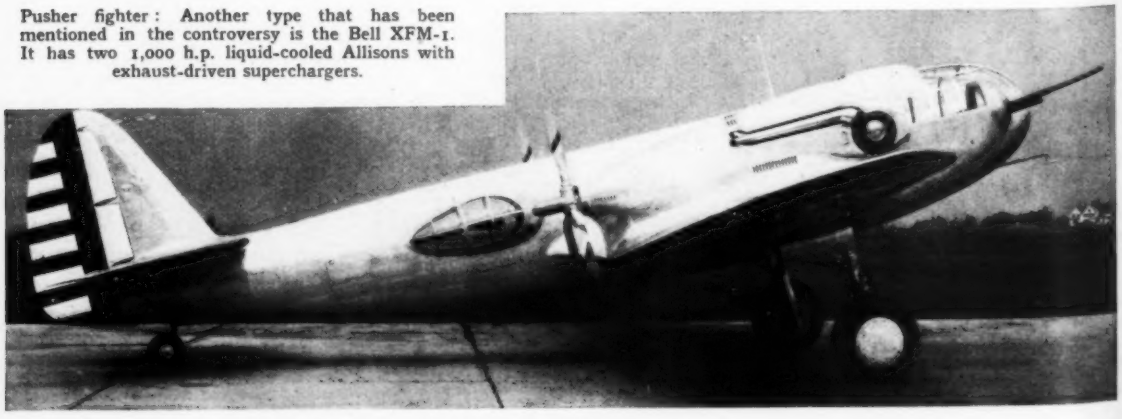
If the American equipment is decided upon, the R.A.F. units receiving these aircraft must train their personnel in the use and maintenance of new types of engines, instruments, wireless, guns and bomb gears, apart from airframe servicing. One can easily visualise a period of six months between the time of a unit receiving its Americans and the time of reaching a reasonable state of efficiency in operating them.

On the other hand, if British engines and equipment are to be fitted, the U.S. manufacturers will have to alter their designs, working drawings, jigs and tools accordingly. It will probably take them at least six months longer to deliver the aircraft—always assuming, of course, that adequate supplies of British engines and equipment are available.

It is rather interesting to try to imagine the possible action of the various departments at the Air Ministry on the placing of such an order in the States.

Contracts Department.—In fairness to the British aircraft industry, the terms of the contracts should not be

Pusher fighter : Another type that has been mentioned in the controversy is the Bell XFM-1. It has two 1,000 h.p. liquid-cooled Allisons with exhaust-driven superchargers.



The Commission: (left to right) Air Comdre. A. T. Harris, Air Comdre. J. G. Weir, Sqn. Ldr. (Cdr., R.N.) Caspar John, Sqn. Ldr. C. E. Horrex and Mr. F. Rowarth.

more favourable, i.e., the U.S. firms should only receive progress payment on the same scale and basis as the British concerns; also, the contract should be placed subject to the usual clauses as to fair wages, cancellation, penalties for late delivery and the like. Will the American firms be allowed to make a larger percentage of profit than do British companies? They will not be paying anything to help our income-tax.

Technical Department.—Presumably this section would be asked by "Contracts" to prepare a detailed specification of exactly what the aircraft are to do as regards speed, climb, load-carrying, manœuvrability, stability, etc. It would also have to check the strength of the American structure to see that it conforms approximately to Air Ministry requirements. It is quite likely that this department would take some four to six months to do this work and contracts, one assumes, would not be placed until it was complete.

Production Department.—It is unlikely that this department would be allowed to interfere with any contracts placed in the U.S.A. The heads of production in the firms that get the contracts will already have an American accent and will have learned from childhood to talk of output "skedules" and "programs." They will not need the help of officials to tell them they "can't do it," "that they should put down another £100,000 worth of plant," and other such helpful remarks.

Inspection Department.—Undoubtedly a number of first-class men from this section will have to be sent over to see that the jobs are good honest ones and safe, but it is doubtful if such large staffs as are placed in British works would be welcome. It should be remembered that the large intricate sets of specification and instruction in use here would be of no use over there; moreover, it would not be possible to send senior inspectors down from headquarters to clear up contentious points. At the same time, if the system were considerably relaxed in favour of the U.S. firms it would become very unfair to the British industry.

Looking Ahead

Equipment Department.—This division will have to forecast its requirements for spare parts and materials for engines, airframe, instruments, guns, cameras, wireless, bomb gear, etc., at the time the main contracts are placed. The British industry has been pressing for such procedure for the last twenty years. The department will have to remember that gauges of plates and tubes, screw threads, etc., are different. Besides covering the supply of spares and materials, they must also arrange provision of the necessary drills, taps, dies, riveting tools and other equipment required for repair and modification work.

Very comprehensive spare part lists, maintenance notes and other literature will be required. It will not be possible for a Service unit to get on the 'phone to the designing firm and ask for help as they frequently do in this country. The maintenance section are going to have all they can do to keep the aircraft serviceable. Of course, arrangements could be made with the American firms concerned to send over a competent staff of engineers and mechanics to supervise maintenance in the Service units.

If we really need the help of the U.S.A. to obtain the total number of aircraft wanted by the R.A.F., then surely it would be better to get them to manufacture some of the British types on which we have already standardised and which (as we have been assured in Parliament) are second to none.

One might take this as a reasonable timetable:

	Months.
(1) Visit of Commission and preparation of report	1
(2) Consideration of report; decision	1
(3) Preparing specification, contracts, etc.	4
(4) Delivery of first aircraft from date of contract	12
(5) Delivery of 1,000 aircraft	24
	42

In other words, it would be approximately three-and-a-half years before we could obtain our 1,000 aircraft from the U.S.A. By intelligent use of the facilities in our own country we could easily obtain this number in two years, in addition to the present rate of output.

I am convinced that if the Air Ministry plans its production requirements in real consultation with the British industry, this country can produce all the aircraft the R.A.F. requires. An engineer speaking English is not inferior to one speaking American; he may not talk as much, but given the same opportunity, financial and otherwise, he can do just as well.

It is a serious matter for any government to decide to spend millions abroad on aircraft, and the whole subject should be thoroughly investigated and thrashed out before any such drastic step is taken.

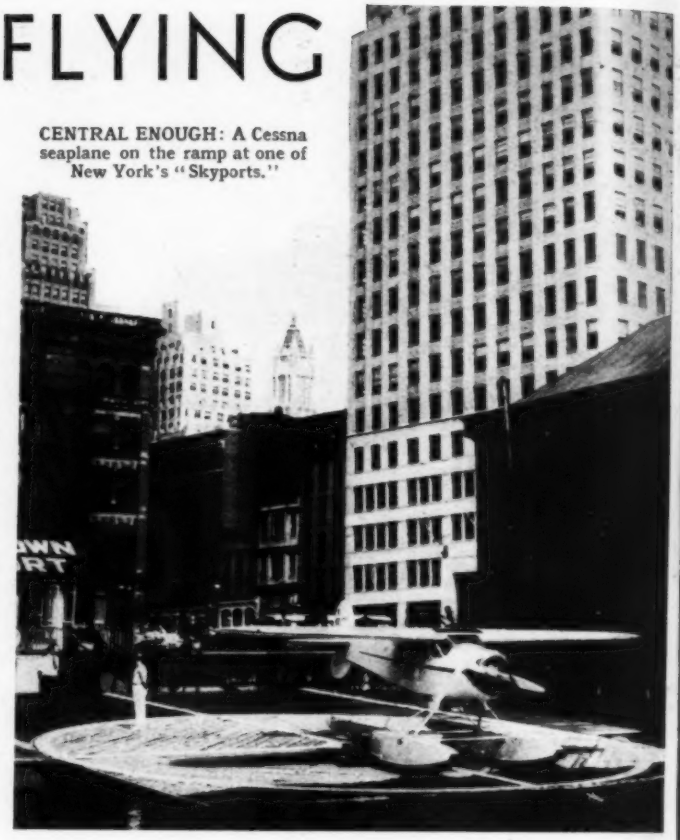
If such a move *is* made its influence on the sales of British aircraft abroad for some years to come can hardly be calculated.

Many people visualise the next war as being a long-drawn-out affair like the last one. Actually, the number of efficient aircraft and personnel we have available *at the beginning* of the next war is the only thing that matters. The numbers of aircraft produced after the war has started are not likely to have a great effect on the result, and there is no reason to suppose that enemy aircraft will concentrate on bombing aircraft factories; they will obtain far better results by attacking electric power and water pumping stations and by destroying aircraft in use at the various R.A.F. aerodromes. For the present emergency period, this country must depend on itself, and the sooner it starts to organise its present facilities the better.

The not-so-little brother of the Boeing XB-15, the YB-17, would be more likely to enter into the present argument. It has four 850 h.p. Cyclone G motors.

PRIVATE FLYING

Topics of the Day



CENTRAL ENOUGH: A Cessna seaplane on the ramp at one of New York's "Skyports."

Seaplanes Again

THERE are moments when I feel very much a supporter of long-since lost causes; my pen scratching in a wilderness of reams of newsprint. The very idea, for instance, that anyone should think of subsidising private owners when it is not even possible to encourage the Government to subsidise either internal airlines or aerodromes. The very idea that anyone should buy and use a seaplane or prepare to lose a lot of money in running a seaplane club. The very idea.

However, I am back on the subject of seaplanes, and now with at least the moral support of one enthusiastic owner and competition pilot who has imported an American lightweight with floats (and, I believe, skis for use, presumably, in Switzerland). The machine is at present fitted with floats and is being flown in the Solent area.

Apparently the endurance of the outfit is not very spectacular, and I hear that the owner has had to bring his machine ashore more than once and walk to the nearest garage for fuel. It is to be supposed that the acquisition of this light aeroplane is merely for the purpose of acquainting its owner with the advantages or otherwise of the seaplane, and that in due course he will purchase something which will be rather more useful.

Practical Experience

IN this country at present is an American businessman-pilot who has been using a floatplane for transport from his home to the centre of New York during the last two years. He hopes to obtain permission to make use in the same way of the Thames, but whether the Port of London Authority will think kindly of the idea of a privately owned seaplane rushing hither and thither on their water remains to be seen. At any rate, he is going to try.

Last week I had a chat with this particular pilot, and he succeeded in convincing me that seaplane flying is easy; that such a machine can, in a number of circumstances, be more useful than a landplane; and that the only real difficulty is, as might be expected, concerned with the purely seamanship side of the business. Obviously, for instance, it is not feasible to point the nose of a seaplane at a jetty and expect to get there. The floatplane, with its vast expanse of windswept areas, is to be compared rather with a sailing vessel, and proper use must be made both of the wind and of the tide when taxying in anything but flat-calm conditions.

Apparently the rotating seaplane ramp in Manhattan is used a very great deal, and during the summer it is not unusual to see a dozen machines parked on dry land after being hauled off the slipway. The metal floats most commonly used in America have stainless-steel keels, and the method of going ashore at Manhattan is simply that of taxying straight out of the water and up the wetted wooden slope of the tilted turntable. Once the machine is in its correct position—a fact indicated by white lines—chocks are put under the heels of the floats and the ramp is levelled and rotated so that the machine may be hauled off to make room for the next. The operation of the turntable is fairly simple, the ramp being raised or lowered by means of ballast tanks and rotated manually.

It seems that more and more American private owners are having their machines converted for use with floats. The work involved in this conversion, quite apart from the additional structure, is fairly considerable, and it is naturally far simpler to buy a machine for the purpose in the first place. All the metal members, for instance, must be suitably treated. Naturally enough, the fitting of floats—which cost about £200 a pair over there—affects the general performance to some slight extent, and the American owners are lucky in that their average machine is extremely adequately powered in comparison with our own. In general, a decrease of about ten miles an hour in the maximum speed can be expected, and there is a fair loss in payload. Nevertheless, the fact that little machines like Aeroncas and Cubs are being flown about quite satisfactorily shows that the loss is not as terrifying as all that.

Handling Differences

THIS pilot also told me quite a number of interesting and rather unexpected things about seaplane flying and surface handling.

During the take-off the seaplane pilot somewhat reverses the order of things, and the operation is vaguely reminiscent of that used for unleashing an Autogiro. The control column is held right back during the initial part of the run until the machine gets on to the step. Thereafter, the stick is held a little aft of neutral until the machine flies off the water. The business of putting the machine down does not involve the exaggerated three-point position affected by a landplane at the moment of contact, and the process is, consequently, rather simpler.

The machine which this pilot has been flying recently has a pair of water rudders which are, however, used only for taxying. In the ordinary course of events they are lifted right out of the water by means of a control in the cabin. If they were left down the whole time there would be a tendency for the pilot to over-rudder during take-off and landing, and they would offer rather too much resistance and would be vulnerable where much-used rivers and estuaries are concerned. These are usually full of logs, broken bottles and dead bodies, and seaplane pilots usually fly up and down the particular stretch of water which they have chosen before actually coming to land.

One of these days I am going to try it myself.

INDICATOR.

FROM the CLUBS and SCHOOLS

STRATHTAY

FOR the week ended April 24 a total of 24 hours flying was recorded, this including cross-country flights to Newcastle, Fettercairn and Renfrew.

BARTON (BEDS)

Two machines attended the dawn patrol at Hanworth on April 24, but were not successful in getting through unobserved. Visitors from Hatfield, Sywell and Cambridge dropped in during the week ended April 30 and several new members joined. A first solo was made by Mr. A. C. Kelway.

READING

Several new members joined last week and machines were in great demand. Three aeroplanes set out for the dawn patrol at Shoreham, but only one, flown by Mr. B. Wardle, got through. The Sunday tea dances are proving extremely popular and will be continued throughout the summer.

C.A.S.C.

On Sunday last the flying times had only reached one hour when work was suspended owing to high winds and low cloud. June 12 has been decided upon as the date for the next open day at Cambridge, and July 3 for the next Continental cross-country trip—Le Touquet being the destination.

MARSHALL'S

For the week ended April 24 some 75-odd hours were flown at Cambridge, and cross-country flights to Romford, Brough, Hatfield, Glasgow and Blackpool were made. Miss Marshall and Messrs. Symington and Arrow completed their "A" licence tests and Messrs. Cater Wingfield and P. C. Garner made first solos.

MIDLAND

At Wolverhampton airport flying for the month of April totalled 98 hr. 10 min., this including 10 hr. 30 min. solo. Twenty-two new members joined the club. At Castle Bromwich aerodrome several cross-country flights, as well as the normal instructional work, brought about a flying total of 125 hr. 35 min. during April. Four members joined.

HANWORTH

None of the five machines which attended Shoreham on Sunday was successful in qualifying for the free breakfasts. An evening balloon-bursting competition will be held on the aerodrome on Wednesday, May 18, starting at 18.00 hours. Mr. R. Calderwood made his first solo, and 94 hr. 40 min. represented the total flying for the week ended May 1.

HYDERABAD

During March the Hyderabad State Aero Club flew 69 hr. 20 min., and Miss Aban P. Chenoy qualified for her "A" licence; she has the distinction of being the first lady member of the club to qualify. At a dance on March 3 the Dinroze Cup was presented to Mr. Khaja Asadullah Khan. Cross-country flights were made to Nirmal, Jangaon, Madhole, and Raichur.

SOUTH COAST

An arrival competition for cars will be held on Sunday, May 15, between 5.30 p.m. and 6 p.m. For the week ended May 1 a total of 24 hours flying was put in. Owing to heavy rain, the dawn patrol was not quite the success it might have been, but the club lounge was very reassuring. Mr. J. Axelrad obtained his "A" licence, and three new members joined.

BORDER

The flying put in during April substantially exceeded that for the same period in 1937, and up to April 29 a total of 105 hr. 35 min. had been logged. The Gipsy Moth G—ABLT, which has been rebuilt in the workshops, was given her first test flight during the week. The Fox Moth is now in the workshops being repainted, and is expected back in a few days.

LIVERPOOL

An aerobatic and forced landing competition was held at Speke on Sunday, April 24, resulting in a win for Mr. R. Farrer James, with Mr. Rex Kingwall second and Mr. Harry Shepherd third. Other competitions to be held in the near future include a cross-country from Speke on Sunday, May 8, and a forced landing competition at Hooton on Sunday, May 15. Numerous cross-country flights have been made to the Continent and aerodromes in England, and for the month of April a total of 229 hr. 55 min. showed the flying enthusiasm of the members.

NOTTINGHAM

An American Badminton tournament was held on Sunday, April 24, the winners being Miss V. Smith and Mr. K. Smedley; Mrs. Leaton and Mr. Marshall were the runners-up. Tournaments are to be held on the last Sunday in each month. A dawn patrol will be held on Sunday, May 15, and various flying competitions are being arranged for the summer. Messrs. Woodhall and Scott made their first solo flights and the latter, with Messrs. Ward and J. Williams, completed his "A" licence tests. Cross-country flights to Heston, Brooklands and Norwich were included in the flying times of 94 hours for the month of April. A member—Mr. T. W. Shipside—is at present touring Egypt in his Leopard Moth.

LONDON

The wedding reception of Mr. H. J. Secker and Miss Cynthia Gott was held at the club last Saturday and the bride and bridegroom were afterwards flown to Lympne by the chief instructor, Mr. J. A. Harris. Flying for the week produced a total of 75 hr. 10 min., and Messrs. F. Geddes and R. Wings made their first solo flights, the latter, together with Mr. R. L. Tanner, also completing his "A" licence tests.

SOUTHEND

High winds prevented the inexperienced soloists from practising over the week-end, but the advanced pupils were able to put in their usual flying time. Dual was quite up to average as, at the moment, the club has more "A" licence candidates undergoing dual than at any time in its history and at least a dozen first solos are expected shortly. Mr. Tony Weber, the president's son, made his first solo last week.

REDHILL

Redhill were intended invaders of Shoreham on Sunday, but were forced to turn back owing to bad weather. Activities during the week included a demonstration of the Taylor Cub and a visit by the entire club fleet to Brooklands one evening. Mr. H. E. Trumper made his "B" licence night flight and Messrs. P. E. Nathan and H. G. Venables carried out first solo flights. Altogether a total of 43 hours flying was put in.

LEICESTERSHIRE

The good flying weather prevalent throughout the country during April helped the Leicestershire Aero Club to an hourage figure well in excess of that for April, 1937—132 hours. First solos were made by the Misses H. M. Phillips and B. Smith. On April 3 all the club machines went to Brooklands for the dawn patrol, and during the month forty-five aircraft landed at the aerodrome. An influx of fifteen new members was experienced.

RAND

Three members of the Rand Flying Club—Miss M. Edgerton Bird and Messrs. C. A. Smith and P. Rout—obtained their "A" licences during March and fourteen new members joined. Mr. H. Rouner assumed his instructional duties on April 1, and a new Tiger Moth—an acquisition which increases the number of the club's fleet to twelve machines—should by now have arrived. Two members of the Rand Gliding Club, Messrs. J. Pullen and C. Seegers, obtained their "C" and "A" certificates respectively.

BENGAL

The fact that only one machine was serviceable during the month of March caused a slight drop in the flying hours put in by the Bengal Club. The total was actually 70 hours. On March 5 the annual flying gymkhana, at which H.E. Governor of Bengal and Lady Brabourne were present, was held. Visitors, apart from Mr. Broadbent and F/O. Clouston, included Mr. St. Barbe, on sky-writing work, and Mr. Dubash, the chief instructor of the U.P. Flying Club, who came over to collect a Taylor Cub.

KARACHI

The total flying time put in by the Karachi Aero Club during last month was just one hour short of the 200 mark and included nearly ninety hours of cross-country flying. Two members—Messrs. O. H. Middleton Smith and N. N. Chatterji—completed their "A" licence tests, while Mr. V. Bates has finished his "B" licence training. Mr. V. R. Jadhav obtained his G.E.'s "C" licence. Instruction has already started on the recently acquired Monospar, and the B.A.C. Drone which has been lent by the Government has also been launched.

BROOKLANDS

The Brooklands Flying Club reinforced the defence of Shoreham in the early hours of May Day for the Dawn Patrol. Contrary to expectations, the weather conditions were so bad that only seven raiders arrived as against seventy last year. Five were intercepted, free breakfasts going to the crews of two Miles Hawks from Bekesbourne. A luncheon appointment has been fixed for Sunday next at Lympne, and the club machines will be accompanied by those of the Redhill Flying Club. Miss Julie Kelly made her first solo and Messrs. C. J. Ommanney and D. G. Moyniham have passed their Hendon tests. A total of 114 flying hours was recorded.

JOHANNESBURG

A new record was set up by the Johannesburg Light Plane Club during March, when more than 810 hours were flown; this exceeds the previous maximum total for a month—that of February this year—by 130 hours. Night flying took place on five evenings, thirteen new pupils were enrolled, and nine pilots obtained their "A" licences.

During last year the Johannesburg club flew 5,753 hours, a figure which, without explanation, must be a record for club flying in this country or in any part of the Empire. Actually, more than 600 hours of this total were made up of charter flights, joy-riding and the like, so that the actual club flying total is a little over 5,000 hours. The highest score last year in this country was, we believe, made by the London Aeroplane Club at 4,660 genuine club flying hours. It would be interesting to know whether any other club has exceeded these figures. During the year 21 pilots obtained their "A" licences at the Johannesburg Club, four obtained their "B" licences, and seven their Instructor's licences. The club fleet at January 1 consisted of 13 machines, made up of five Tiger Moths, four Moths, two Hornets, one Leopard and one Moth Major.

PRIVATE FLYING (CONTINUED)

Tricycle Pusher

THE Arpin pusher, the general layout of which has already been described and illustrated, was due to make its first test flight yesterday in the hands of Mr. Wynne Eyton. If all goes well the machine will probably be seen at Sunday's Garden Party at Heathrow. It will be remembered that the Arpin is a tandem two-seater cabin pusher monoplane with a tricycle undercarriage. The prototype is fitted with a 68 h.p. British Salmson.

Seaplanes Again

ONE of the regular visitors to Europe from America is Mr. A. E. Ulmann, of Aviation Equipment and Export, a company which handles, among other things, the well-known Edo floats in Europe. Last week we saw, by courtesy of Surrey Flying Services, a colour film which he had brought over, dealing with a Cessna on floats. The machine was operating from one of New York's rotating seaplane ramps, and the film showed not only the method of using the ramp but also gave an excellent idea of the Cessna's manners in its marine guise.

This Subsidy

THE County Flying Club has made an application to the Air Ministry for at least a proportion of the subsidy granted to flying clubs. The Club is, of course, at present ineligible because it is using the American Taylor Cub, of which it has two in very full occupation.

The Club has asked the Air Ministry to receive a deputation of members. It will be pointed out to the Ministry that, while the Club is certainly using foreign machines, it is producing British pilots. The question will be whether the subsidy was intended as an incentive to the training of pilots or the production of light aeroplanes—or both. If the answer is "both," then the County Flying Club say that they should be entitled to an amount of the subsidy proportionate to the value of the pilots trained. Very reasonable.

A Madras Month

IN the words of the somewhat literary secretary of the Madras Flying Club, "March weather prevailed, as expected, during March, its utter serenity disturbed, however, by a torrential noontide thunder-shower in the latter half of the month, thirstily welcomed by the parching aerodrome—a very strange phenomenon indeed." And, indeed, an outstanding amount of flying was done during the month, a great deal by Mr. Sundaram, who flew the Leopard both to Colombo and to Trivandrum.

Mr. Aserappa took a Gipsy Moth on a flight which was to include visits to Bombay and Hyderabad, but circumstances imposed a change in his programme and he landed first in a field at Gadag, near Hubli, and a couple of days later on the Coromandal Beach, whence he was rescued by Mr. Law, the instructor, who flew there in another Gipsy Moth, shared out the petrol and both machines flew to Pondicherry for fuel, landing on a bit of waste ground.

There H.E. The Governor entertained the two to lunch, and it was immediately decided to hold a joy-riding week at Pondicherry with the least possible delay, using that newly discovered and most convenient bit of ground. A Gipsy Moth and a Leopard were started in on the job, but, after two days, labour troubles in Pondicherry necessitated the withdrawal of the guardian police and there was no option but to cease operations.

Returning to rather more prosaic facts, Messrs. Fernando and Achyuta Rao qualified for their "A" licences. On March 27 thirteen pilots competed in a bombing competition, of which the winner was Dr. R. J. Dyson, with Messrs. A. S. Ratnam and J. D. Italia as runners-up.

WEDDING: On April 26, at Holy Trinity, Brompton, Miss Dorothy Spicer, the well-known aeronautical engineer, was married to Flt. Lt. Richard Pearse. Miss Spicer will be particularly well remembered as Miss Pauline Gower's ground-engineer during a long and venturesome partnership in display-flying and joy-riding.

Reprieve for the Cygnet

TO the many who felt regret on the announcement that production of the Cygnet, Britain's only all-metal, stressed-skin, light civil aeroplane, had ceased, there is good news in the information that an agreement is being entered into between C.W. Aircraft and General Aircraft, Ltd., by which the whole of the Cygnet design, manufacturing rights and work in progress will be taken over by General Aircraft.

The designers, Messrs. Chronander and Waddington, have joined the technical staff of General Aircraft to continue the development of the design.

Some improvements are to be made in the production model of the Cygnet, and manufacture will commence as soon as these have been tried out. It should be ready for delivery early in 1939.

C.W. Aircraft, in which Messrs. Chronander and Waddington retain their interest, will cease to manufacture aircraft for the time being and will concentrate on jig and tool making, particularly for the aircraft industry. The company has 70 men employed.

The Cygnet will make its first appearance under the ægis of General Aircraft, Ltd., at the R.Ae.S. Garden Party.

Next Sunday's R.Ae.S. Garden Party

STUDYING the programme of next Sunday's R.Ae.S. Garden Party, it becomes apparent that only fine weather is needed to ensure the success of this important curtain-raiser to the flying season.

Visitors, it is hoped, will see the Armstrong Whitworth Ensign and the De Havilland Albatross, while large military types may be represented by the Bristol Bombay, Fairey Battle and Vickers Wellesley; there should also be a Lysander present.

With the exception of the Percival Q.6 and the Miles Monarch, there will be little of outstanding novelty among the smaller civil types, but those demonstrated will be thoroughly representative.

The Kay and Hafner Gyroplanes and the Cierva "jumping" Autogiro are sure to cause something of a furore, while other unorthodox types will include three tricycle representatives, the Scheldemusch, the Monospar T.42, and the new Arpin monoplane.

Again this year some historic aircraft will be shown, and perhaps flown; they will include a 1911 Deperdussin, a Fokker D. VII, a Sopwith Pup and a 1917 Henriot. There will also be a demonstration of winch launching of sailplanes.

A static show of accessories and equipment will be held in the large hangar.

The venue, as usual, is Fairey's Aerodrome at Heathrow, which is a short distance west of the Great West Road extention that links the Bath Road and the Staines Road. To-day is the last day for application for tickets (5s. including tea), which are obtainable through members of the Society.

The Air League Dinner

LORD SWINTON, Secretary of State for Air, and Sir Thomas Inskip, Minister for the Co-ordination of Defence, will be the principal speakers at the annual dinner of the Air League, to be held at Grosvenor House, London, on May 17. The League's President, the Duke of Sutherland, will be in the chair.

Among those present, also, will be Lord Londonderry, Marshal of the Royal Air Force Lord Trenchard, Lord Lloyd, Sir Francis Shelmerdine, Sir Donald Banks, and Air Chief Marshal Sir Cyril Newall.

COMMERCIAL AVIATION

INTERLUDE: On the face of it, hardly an air transport subject, this photograph of Mr. H. F. Broadbent (with two sentries and five porters), standing in front of his sun-protected Vega Gull at Sesok, on Flores, where he landed on his outward record attempt. Nevertheless, Qantas, K.L.M. and K.N.I.L.M., not to mention the Netherlands navy and the D.H. company, made it possible for a new airscrew to be sent and fitted in record time. The story of his record homeward flight appeared in last week's issue.

THE WEEK AT CROYDON

"A. Viator's" Weekly Causerie on Airline Affairs at London's Main Terminal and Elsewhere

LAST week, chiefs of Air Lingus Teoranta, the Irish company, flew to Holland. There, it is understood, they displayed considerable interest in the K.L.M. Lockheed Fourteen.

Like British Airways, they know what they need and are determined to have it; and as the purchase of Lockheeds by British Airways followed a visit to Holland, I should not be surprised to see the Irish company's name (in good Erse) on the sides of a fleet of Fourteens before many moons have waxed and waned.

On Wednesday of last week the Prime Minister of France, M. Daladier, and the Foreign Minister, M. Bonnet, crossed from Paris by Air France in the Bloch—which machine, by the way, is collecting quite a lot of the Paris passenger traffic, for it combines speed with comfort, and at the same time has the size and dignity of the real airliner. The public, any traffic man will tell you, does not really like small aeroplanes.

M. Daladier, when he disemplaned at Croydon, was carrying a hat box which, one suspected, contained a phenomenally tall, tall, hat. He is one of France's shortest politicians (in the Cabinet, anyway) so we sent Lord Halifax to meet him, who is surely the tallest member of the British Cabinet.

The closely guarded secret of the new main hall office at Croydon Airport, which used to be part of the ladies' lounge and cloakroom, is now revealed. North Eastern Airways have taken this room and will presumably abandon their small hall office.

From all points of view, save, perhaps, that of lounging lady passengers, this new office is a great improvement and another excellent innovation is a portico, with draught-proof doors, to the emigration hall.

Before its erection, it was rumoured, passport officials were liable to be frozen rigid and had to be rubbed with snow by the Airport doctor.

Richard Tauber, with monocle (and why not? they are not the perogative of the Army and Diplomatic Corps), arrived by Swissar last week from a holiday in Zurich, and Dr. Malcolm Sargent flew to Palestine, where he is to conduct a concert at Tel Aviv. He made use of the "Rome Air Rapide"—a combined K.L.M., D.L.H., and A.L.I. line—as far as Rome and thence by the Italian Ala Littoria to Haifa.

Combined air services become more and more fashionable as longer lines develop and aviation politics become more complicated. Two good examples are the K.L.M.-C.L.S. route *via* London, Prague, Vienna, Budapest. The Cechoslovakian and Royal Dutch companies run this line on such complete co-operation that their flying stock of Douglas machines is practically identical unless you look at the registration letters on the fuselage. Another example is the A.B.A./K.L.M. Scandinavian Air Express, where flying stock and organisation throughout are identical.

If it is by any means avoidable never have your passengers change from one type of aeroplane to another on a trip. Comparisons are odious, and passengers prefer to make the odious sort, if they can, *experto crede!*

I hear that the first Lockheed Fourteens to be seen in that part of the world have arrived at Soerabaya, Dutch East Indies, where the Netherlands Indies company, K.N.I.L.M., is assembling them. They will be flown to Bandoeng to be tested. These machines are designed for the K.N.I.L.M. link-up between Batavia and Sydney, which will be, I suppose, a two- or two-and-a-half-day schedule.

Late Arrivals

Sooner or later (and the sooner the better) companies will have to get together and make a really firm stand against the passenger who turns up a minute before the scheduled departure time of the passenger coach from London terminals or who disembarks like a shot from a gun from his private car at the airport and giggles because (a) he has kept the liner and, incidentally, some twenty other passengers waiting, and (b) because the company has been mug enough to wait for him.

It is more and more necessary to get away strictly to time and, bar very exceptional weather conditions, it is not difficult to do so, except for these last-minute passengers. The combination of the late passenger and a strong head-wind is going to upset all sorts of vital connections somewhere on the Continent, and may cause passengers on long-distance routes to make a night stop which would have been saved by punctual departure.

Passengers have in their bonnets two bees which at times assume all the attributes of fighting hornets. One is that these air people are easy and will always wait for one, and the other is that you can leap from car to plane as if

COMMERCIAL AVIATION (CONTINUED) : WORLD NEWS

you were merely train travelling. Apart from luggage weighing, collecting excess baggage, money and so forth, there is the completion of the planes' documents and then passports. Passport officials may not like the passenger's face, for, indeed, late passengers never look quite human to those who are plagued by them. All is lost, of course, as soon as they start comparing the traveller's face with his passport photo. Not only is the one utterly unlike the other, but it takes time to decide which is most unlike any known representation of *homo sapiens*, alive or dead.

That sort of thing, by which I mean essential pre-departure formalities, is what caused a learned lecturer to plant a decisive heel on an evasive banana skin when he decried European air transport in comparison with American ditto. He said they did things so much quicker over there, forgetting that American flying is mainly internal flying, and that there are no passport formalities coming in or going out, and no lengthy and complicated Customs formalities for freight, let alone the hold-up of an inward passenger so foolish as to fail to declare dutiable articles.

Combined Events

THE new airport of Helsingfors, Finland, will be officially opened on May 15 in conjunction with the international aero exhibition, SILI, which opens on the previous day. The aero exhibition is staged at Mässhallen and will be kept open until May 22.

The Italian Disaster

ON April 30, at about 2 p.m., the Savoia-Marchetti S.73, on the Ala Littoria Tirana-Rome service, struck the mountains above the Cupa Valley, near Maranola, between Brindisi and its destination. All the nineteen occupants, including M. Jafer Vella, the Albanian Minister in Rome, lost their lives.

A Wrightways Loss

FOLLOWING an accident at Croydon on the evening of April 25 to a D.H. Dragon which had been out on Army co-operation work, Mr. C. C. Byar, one of Wrightways' pilots, died in hospital on Thursday of last week.

The cause of the accident still remains a mystery. The machine was apparently circling the airport preparatory to making a final approach and landing, and it suddenly glided from view beyond the south-western boundary. An examination of the wreckage disclosed the fact that both petrol taps had been turned off, but that there had been ample fuel aboard at the time of the accident. The taps on the Dragon cannot be turned off by accident, nor can they be reached quickly, and the machine had been flying for two and a half hours.

North Sea Service

ALLIED AIRWAYS have been granted a concession by the Norwegian Government to extend their Newcastle-Stavanger Line to Oslo and to run in pool with D.N.L. northwards to Bergen. Incidentally, on April 28 a number of Scottish pressmen, travelling as guests of Allied Airways and North-Eastern Airways, flew from Glasgow and Edinburgh to Stavanger and back in eleven hours—eight of which were spent in actual flying. The service, of course, was run last year, but this is the first occasion on which it has been directly linked with Glasgow.

The recently opened North-Eastern Airways' service between Renfrew and Newcastle is timed to meet the Allied D.H.86, and it is now possible for travellers to leave Glasgow's airport at 9.45 a.m., spend an hour in Newcastle and be in Stavanger at 1.50 p.m. The same connection, of course, can be made by passengers travelling with North-Eastern Airways from Perth and Edinburgh, and similar connections can be made in the reverse direction.

Ringway Opening

THE date for the official opening of Manchester's new airport at Ringway has now been definitely given as June 25. Sir William Davy, the chairman of the Airport Committee, announced last week that Lord Swinton would perform the ceremony.

Ringway lies eight and a half miles due south from Manchester's centre, and even now can, it is claimed, be reached in half an hour by car. The landing area available in June will give clear runs of 1,100 yards in every direction, but an additional area is in the process of being taken in, and this area will give a maximum bad-weather run of 1,300 yards in one direction. A single large hangar is at present being built and work is also proceeding with the control and administration building. The work on the site originally started on November 28, 1935.

There have been rumours—duly denied—that Barton airport will be sold for industrial development purposes. That remains to be seen. There is no reason at all why a city of Manchester's importance should not own two aerodromes. At any rate, Barton is likely to remain as a central radio control station for the North Midlands.

The Tasman Service

ACCORDING to a statement made recently by Mr. M. J. Savage, the Prime Minister of New Zealand, the projected Tasman Sea mail service should be in operation before the end of this year. Within a day or two the Governments of the United Kingdom, Australia and New Zealand will have officially nominated companies to represent them in the necessary discussions, and in a few months the scheme should be taking practical shape.

The through flying boat service to Sydney is expected to be started in July. For a start flying boats will be used for two services each week, while land machines may be used temporarily for the third. It is expected that before the end of August the complete scheme will be in operation.

Aberdeen Affairs

LAST week representatives of the Aberdeen Town Council discussed with Air Ministry officials the question of the future of Dyce Aerodrome. A few days previously Mr. Gandar Dower, the managing director of Allied Airways, who owns Dyce Airport, had been served with a notice to treat for the compulsory purchase of the airport by the Air Ministry—who required it for Service purposes. Mr. Gandar Dower at once wrote a letter to the Aberdeen Chamber of Commerce asking that a representation should be made to ensure that the civil flying facilities at Dyce should be able to continue in the new circumstances.

At the meeting the Ministry representatives gave an assurance that, in the event of the acquisition of the aerodrome, the arrangements made would be such as to enable civil flying to be continued without restriction.

Apparently there had been a certain amount of disagreement about the arrangements concerned in the renting of Dyce for the use of the Auxiliary Air Force, and this possibility of compulsory purchase is the final result. According to Mr. Gandar Dower the Air Ministry demanded that the aerodrome should be extended over two streams—work which would involve the expenditure of some £15,000—and that there should be no limit to the number of machines using the aerodrome. Furthermore, they retained the right to terminate a fourteen-year lease at the end of seven years.

The Renfrew Business

ON Tuesday of last week the newly formed Scottish Airways ran inaugural services in each direction between Renfrew, Perth and Inverness, carrying heavy loads of important personalities in each of the four machines used.

Unfortunately, the flights were not quite the occasion for congratulation which they might have been expected to be. During the official luncheon at Perth, Major D. K. Michie, the Provost of Renfew, intimated that Glasgow's aerodrome might be closed down very shortly. He said that this decision was the direct result of "procrastination and discourtesy" on the part of the Civil Aviation Department of the Air Ministry. Since September 24, last year, intermittent discussions had been in progress, but since March 22, when a letter had been received stating that the Air Ministry would shortly be in a position to send representatives to Renfrew for further discussion of the new traffic control plan, no further communication had been received.

The Scottish Flying Club, who had been told that their lease would terminate, sent various telegrams demanding the co-operation of the Air Ministry, the Aerodrome Owners' Association, Lord Weir and Lord Swinton himself in avoiding the calamitous possibility. A day or two later the Air Ministry sent a telegram to the Renfrew Town Council explaining that, though the entire question of airport arrangements for the South of Scotland was still under review, they could take it for granted that Renfrew would remain as Glasgow's terminal airport for at least two years to come. Editorial comment on this matter appears on page 433.

SERVICE WITHIN A SERVICE

How Imperial Airways Ensure Safe and Reliable Aircraft Operation on the Empire Routes : A Visit to the Flying Boat Servicing Establishment at Hythe

"Flight" photograph.

IMPERIAL AIRWAYS' servicing establishment at Hythe occupies half the old Supermarine Works on Southampton Water, and is used exclusively for maintenance of the Empire flying boats. It is a busy and altogether fascinating place. A week or two ago, when we had an opportunity of inspecting the works, there were eight Empire flying boats on the station—four in the water, three in the sheds, and one on the concrete having its engines run up prior to being launched.

After a boat has landed its passengers it is either taxied or towed by a Power Boat to Hythe, where it is moored until the station is ready to receive it. Then the beaching wheels are floated out and attached to the hull, the machine is towed up the slipway by a tractor, and taken into the shed for servicing and a general examination of all parts.

A special tower truck is used for inspecting and, when necessary, removing the engines. This truck has a special oil tank and receiving funnel so that used oil can be drained without mess, and there is also a container fitted to the truck to take cotton waste. The result of these precautions is shown in the unusually clean state of the floor of the shed; there were no splashes of oil or dirty waste lying about. The engines are cleaned down and serviced generally, but top overhauls are carried out at Croydon.

Each engine undergoes a top overhaul after 250 hours' running, which is approximately equivalent to two Empire trips, the flying time between Southampton and Singapore being about 140 hours.

The care given to the inspection of the variable-pitch airscrews was most noticeable. A special corner of the main shop was devoted to this work. The entire surface of the blade is examined under a magnifying glass. The hub mechanism is dismantled for inspection, a Magnaflux apparatus being used for detecting any cracks that may occur in steel parts. The slightest bruise or mark on the blades is indicated for the attention of the chief inspector. If he is satisfied that the damage is superficial, it is carefully worked out with scrapers. There is also a balancing plant to ensure that each airscrew is in perfect balance before it is replaced. It was stated that the amount of replacements had been so far negligible, which is a high tribute to the D.H. airscrews, considering the arduous service to which these are subjected on flying-boat work, especially when taking-off from rough water.

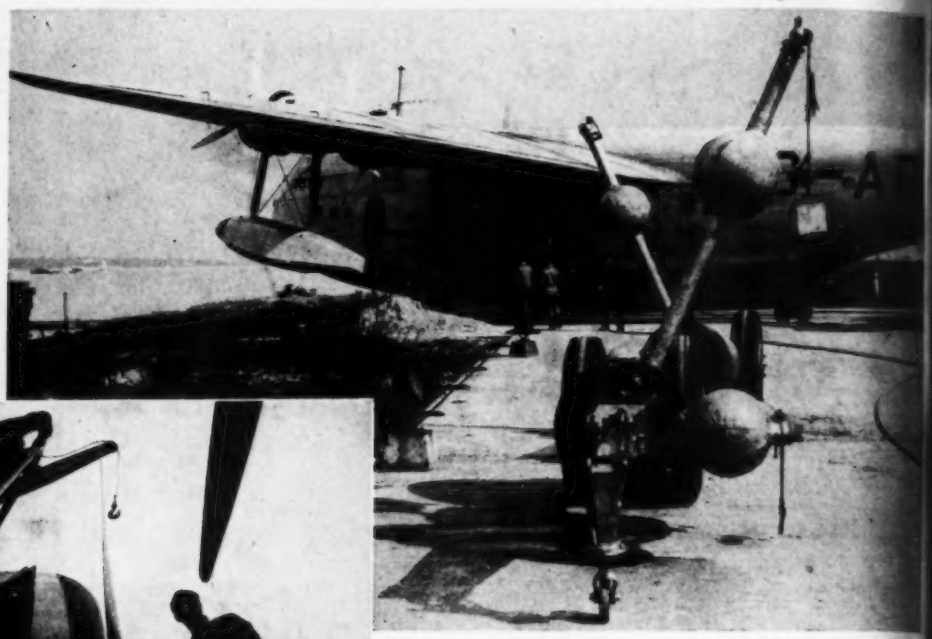
The condition of the hulls was particularly interesting. There was no sign of pitting in the bottom plating, but a small amount of staining was noticeable below the waterline; above the waterline the metal was bright. The general condition would suggest that the amount of corrosion was negligible, and that no trouble need be expected from this source. The principal damage was due to bumping by boats, and the wing-tip floats seemed especially liable to suffer in this way. There is a special shop at the station equipped for dealing with this type of repair, and while we were there a severely damaged float was having its bow plates renewed. There is, of course, no risk to the safety of the flying boat from minor damage of this type, as the floats are well supplied with watertight bulkheads.

One wondered what strange native craft and floating debris had been responsible for the various little dents in the hulls; but the general impression was that the skin had stood up to its work wonderfully well. Slight leaks due to such causes are not infrequent, but they are easily detected by measuring the amount of bilge water found on board.

Old car tyres, cheapest, most efficient and most pardonable of makeshifts, flank the Hythe slipway as fenders against the Power Boats which tend *Castor* and her sister machines. *"Flight" photograph*

(Right) *Castor* on dry land. The surrealistic piece of mechanism is the beaching gear, with its buoys.

(Below) A derrick, for which fittings are provided on the engine nacelles, assists in the servicing of the Pegasus Xc engines and D.H. airscrews. Note the oil-draining funnels on the staging.



"Flight" photograph.

All chairs, floor coverings, etc., are removed from the boats for cleaning and repairs, and table linen and so forth is similarly dealt with. The efficiency in this direction was shown by an examination of the interior of a boat just ready to go out; everything seemed in clean and new condition.

Ailerons and flaps are invariably dismounted for inspection and repair, and there is air-brush equipment for redoping the aileron fabric. Cleaning and greasing of the controls is, of course, a routine job.

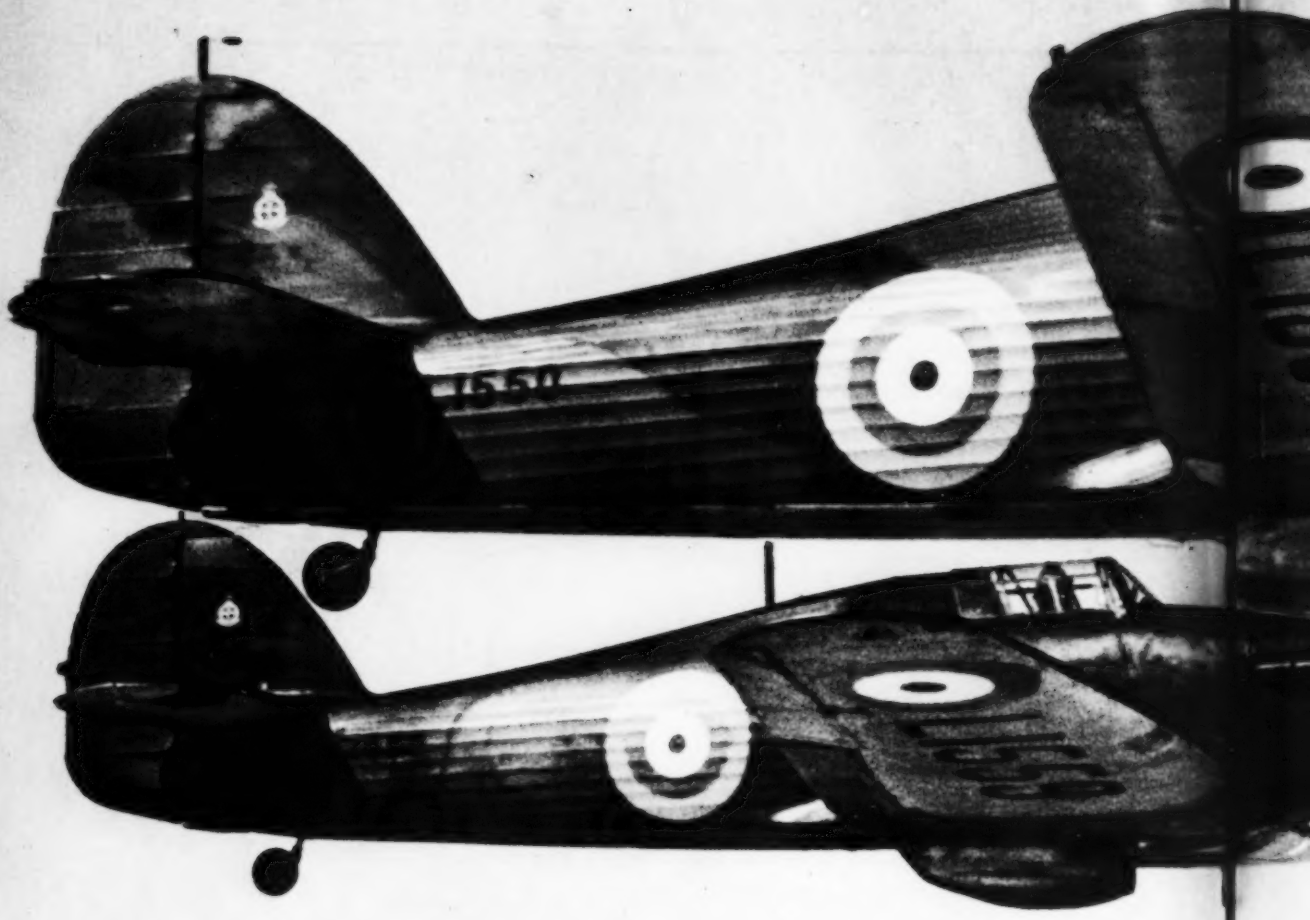
In another shop, devoted to wireless work, the Marconi sets are overhauled. There is also a receiving set here and a 150-watt short-wave transmitter operating on W/T. We were informed that this equipment usually enables contact to be kept with the boats at least as far away as Alexandria, and, under exceptional conditions, even as far as India. A new plant, shortly to be installed, will enable all boats to be in contact with their base in whatever part of the world they may happen to be.

This establishment has been operating for just on a year, but will not be in full swing until, in the near future, the remaining portion of the Supermarine Works has been taken over; shed accommodation should then be available for at least eight boats, with plenty of room for working on them.

Tail wheels—and a nice line in nether garments. (Left) More surrealism: The curious objects depending from the bow hatch of *Coorong* (a Qantas boat) are drogues, or sea-anchors, hung out to dry.

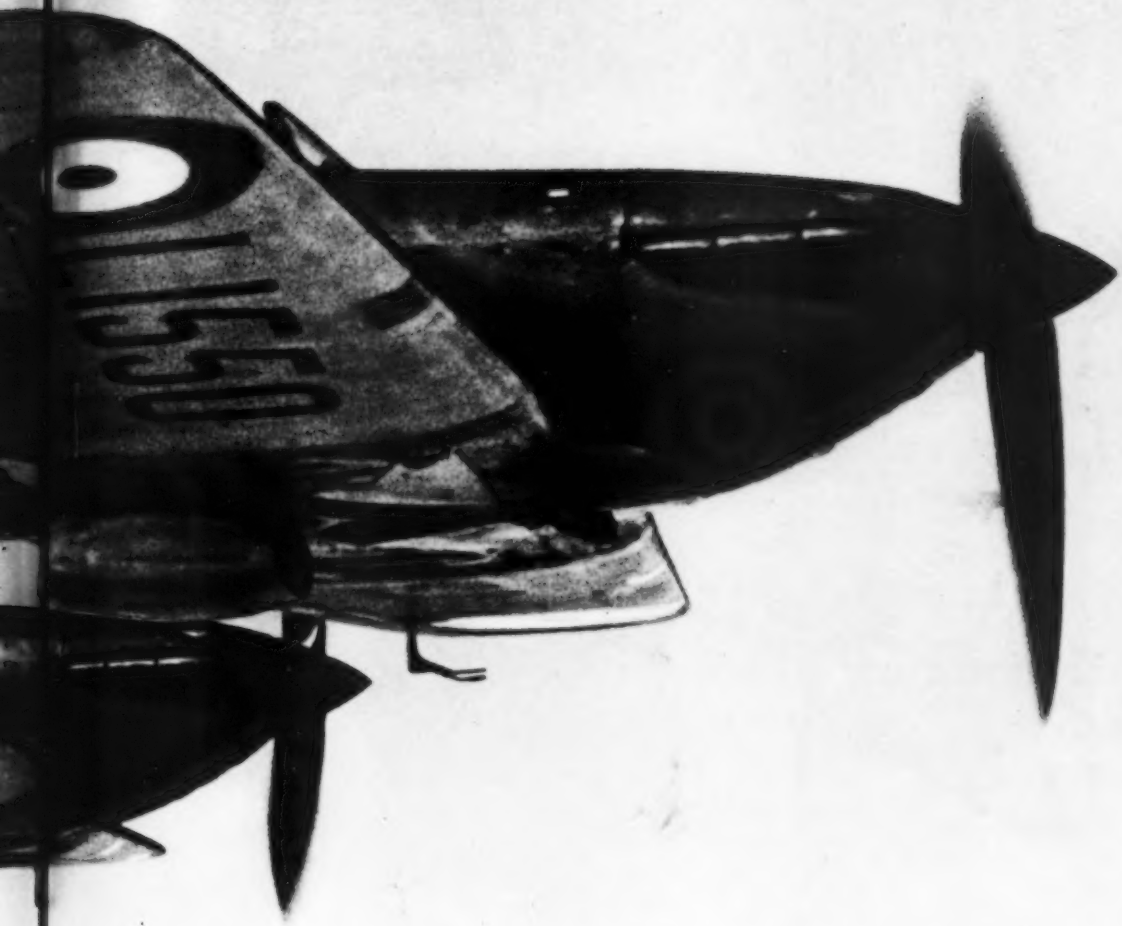
THE THIRD ERA

SCHOONER, steamer, and long-distance flying boat: a page of transport history. The schooner is "Westward," now carrying cruising passengers instead of grain cargoes; the Short Empire flying boat, pictured by a "Flight" cameraman at Hythe, is "Castor."



A NEW PHASE

NO. 111 (Fighter) Squadron from Northolt, with the Hawker Hurricane (Rolls-Royce Merlin) multi-gun fighter, may be said to be making Service history : as the first unit to be equipped with the "300 plus" monoplane fighter they are busy evolving the new technique of aerial warfare which that type demands. This striking aerial photograph is one of a series specially taken by the chief photographer of *Flight* for the Royal Air Force Pavilion at the Empire Exhibition, Glasgow, opened this week.



FORMIDABLE FORMATION

SOME of the machines of No. 111 (F) Squadron and the pilots who man them : two more pictures from the series taken by *Flight* for the Royal Air Force at the Glasgow Empire Exhibition ; some of the photographs are being displayed as outsize enlargements, and play an important part in the motif of the exhibit, which is "The Defence of Britain."

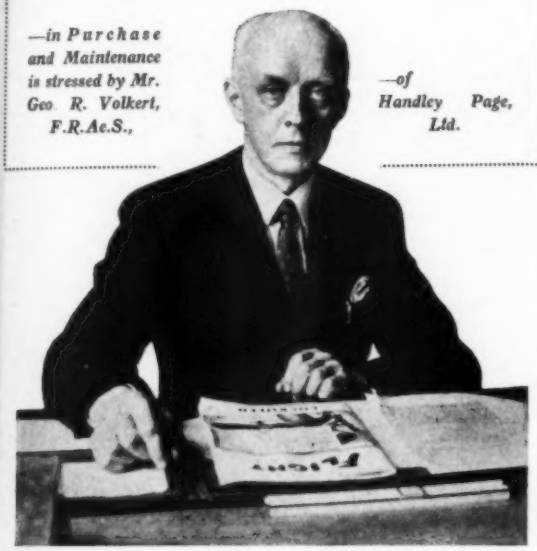
More Famous Designers on—

COMMERCIAL AIRCRAFT of the FUTURE

Continuation of a Notable Feature of Last Week's Issue : Some Eminently Sound Prophesying

Importance of Low Cost

—in Purchase and Maintenance is stressed by Mr. Geo. R. Volkert, F.R.Ae.S.,



—of Handley Page, Ltd.

ANY attempt to forecast the design of commercial aircraft of the near future must take into account those new conditions which have arisen in the past few years as a result of the enormous output of military aircraft in so many countries. As soon as even a part of the vast production facilities which will shortly be available for military aircraft is released for the construction of commercial types, the lessons learnt in the mass production of military designs are bound to have their effect.

The large civil prototype has already become a highly costly production, and in view of the intense competition between the many elaborately equipped manufacturing plants, a purely private venture is going to be very much of a gamble.

The problem is not going to be to design an efficient commercial type so much as to foster conditions such as will create a demand for a very much larger output of commercial machines than has hitherto been justified. With modern methods of construction, the useful life of an aircraft is no longer determined by structural deterioration, but purely by obsolescence, and even to-day we have many notable examples of machines seven or eight years old which are still operating safely and economically.

Quite a small number of aircraft suffice to carry the whole of our mails, so that we must rely upon passenger and freight carrying as the main purpose for civil types. To increase the demand, primary considerations must be cheapness and reliability. Cheapness both in first cost and in maintenance are essential, as well as economy in operation. For these reasons I do not look to a cruising speed exceeding 200 m.p.h. for normal services, or 250 m.p.h. for mail or "transcontinental" stratosphere work.

Expenditure on larger aerodromes will enable smaller and more economical aircraft to do the same work, whilst the claims of the diesel engine will have to be carefully considered. Power units will be completely self-contained, with cooling losses reduced and eventually entirely eliminated.

The aircraft itself is likely to retain the classic low-wing formula for some years, but one looks to a great improvement in means for lateral control, and to an extended use of irreversible control mechanism. Further refinement will take place in the external form and finish, particularly of bodies and power unit, all the elements of which will comply with carefully generated aerodynamic shapes correctly related.

As regards the size of future commercial aircraft, whilst very large types will be built, we must remember that the "*Queen Mary* type" never really pays, and that we must rely upon machines of reasonable size which are comfortable and which can economically operate a very frequent service—machines of the capacity of the Empire boat, the H.P.42 or even the D.C.3.

The great need is to effect such substantial reduction in manufacturing and operating cost that air travel may become the normal means of transport. We must first of all tap the highly lucrative passenger traffic, which is carried to-day by steamship, such as to Madeira or the West Indies during the winter months, as well as the entire winter sports and Riviera traffic. This change will not take place until it is *cheaper as well as quicker* to travel by air. Secondly, we must get the man-in-the-street to become travel-conscious as well as air-minded, to realise that he can easily include a visit to far-distant lands within his fortnight's annual holiday. When the proper demand is there, the right machines will be available.

Small Size

—advocated by Mr. J. Lloyd, of Armstrong Whitworth

WE will begin by assuming that everything has been done to reduce skin friction and interference drag to their lowest possible values. For a given weight, the aircraft must be as small as possible, in order to reduce the wetted surface to a minimum. This has the obvious advantage of reducing the drag and structure weight, enabling the aircraft to fly faster and carry more load. The wing surface can be reduced by using high wing loadings up to 45 lb. per sq. ft., at which loading the aircraft can comfortably take off, given sufficient horsepower.

Photo: E. W. Appleby.

The limiting factor is landing speed, and in normal circumstances the landing is at the end of the intended journey, when most of the fuel is used. The wing loading would then be about 35 lb./sq. ft., which I do not consider excessive.

The body must be kept small by limiting the volume to 60 cu. ft. per passenger, and very careful thought will have to be given to providing the passengers with every comfort without resorting to the obvious, simple expedient of increased cubic capacity.

Engine cooling drag will have to be reduced to a minimum. This can be achieved by reducing the frontal area still further, or installing the engines completely inside the wing. The aircraft will have a power loading of 7 or 8 lb./b.h.p., to enable it to take off under its own power with a reasonable pay-load and fuel for a range of, say, 2,000 miles and to fly at the most economical cruising speed, which would be over 250 m.p.h., at 20,000 ft. at about one-third maximum take-off horse-power. With half the number of engines stopped the ceiling would be about 12,000 ft, using medium supercharged engines. The engines would be extremely reliable working at such a low percentage of maximum power, and at the reduced r.p.m. the tip speed of the airscrews could be kept within reasonable limits.

Speed or Economy?

Mr. D. L. Hollis Williams B.Sc., F.R.Ae.S., of General Aircraft, on "The Parting of the Ways"

IF the present race for speed in commercial aviation continues it will lead to a parting of the ways. Whereas the machine built to maintain national prestige will continue its development to attain still higher speeds, a reversion will take place in favour of the aircraft designed to operate on purely economic principles for use outside the competitive zones.

Photo: Kay Vaughan.

In addition to high speed, prestige also demands the highest standard of safety and reliability so that the travelling public may have confidence and use the airlines freely. It is important, therefore, that a high standard of safety should be demanded and maintained.

The modern airliner is structurally sound and it can perform all the flying manœuvres and operations demanded of it with safety. In the event of failure of one of its engines it can carry on for long distances on the remaining power, and the problem of blind landing is well on the way to a successful solution. There is one weakness, however, which tends to be passed over and should receive attention.

A number of types operating on main airlines at present are known to have a period during the take-off when the occupants are in grave peril should one motor cut out or lose a considerable portion of its power. Reliable as motors are, this is a risk which the airline passenger should not be asked to face.

The present take-off requirement is that an aircraft flying at full load should be able to clear a 66ft. barrier at a distance of 660 yards from the start. No requirements are at present laid down for emergency conditions.

Sooner or later, possibly as a result of actual accidents, it is likely that a regulation will be introduced requiring an aircraft to be able to clear a 66ft. barrier at some reasonable distance—say, 880 yards—after one motor has cut out at airborne speed. A definite I.C.A.N. regulation should be laid down to meet this risk, thereby bringing all signatory nations on to an equal footing.

This will tend to penalise the twin-engined aircraft by making it carry more reserve power, but will present no difficulty to the average three- or four-engined aircraft.

It is probable, also, that long sea crossings will be prohibited on passenger landplanes which cannot maintain a height of at least 3,000ft. with any one motor cut out, and with the others not exceeding their normal full power.

Considerations of safety such as these will tend to prevent the use of ultra-high wing loadings on landplanes and for aircraft cruising in the region of 200 m.p.h. A recent investigation showed that a really high wing loading could offer no substantial improvement and would seriously reduce safety.

A further point of interest which transpired was that a four-engined aircraft which complied with these safety requirements at normal load could also take off at considerable overload for an ocean crossing without the help of accelerators, recourse to composite air launching, or refuelling in the air.

The flying boat should, on the other hand, enjoy unhampered development in this respect, and it may well be that artificial aids to take-off may come into practical use for flying boats with high wing loadings.

Construction.—In its development the airliner will continue along all-metal monocoque lines, as this type of structure is immune from troubles due to rapid change of climatic conditions, and it presents the smart appearance so essential for airline work. This construction has firmly established itself through freedom from maintenance troubles, and it has the advantage that, if structural damage should be sustained, it is immediately apparent by buckling of the skin. Thus, apart from a superficial examination, all inspection vigilance can be directed towards moving parts.

Because of increased wing loadings, structures are getting so dense around the centre section that a reversion to stainless steel may now be considered without sacrificing weight, and this will lead to a reduction in manufacturing cost, due to the ease of assembly of this material by welding. The extremities of the structure are likely to remain in light alloy.

Sub-stratosphere Flight

Pressure Cabins and Operational Height.—In order to gain the maximum operational advantages from engine development there will be a tendency to increase the operational height. This does not mean that so-called stratospheric flight will be indulged in as a normal operational condition, but the present tendency to operate at about 10,000ft. will probably be increased to the neighbourhood of 20,000ft. The ability to do this without inconvenience to the passengers will be due to the universal adoption of a pressure cabin which is the biggest single contribution to passenger comfort likely to occur in the near future, and it will have a tremendous effect on increasing the popularity of air travel.

Shape.—The shape of the aircraft as we know it to-day is unlikely to vary appreciably. The "flying wing," which is the distant objective of all designers, may materialise in the case of aircraft above 100,000 lb. all-up weight, but below this it would mean that the camber of the wing would have to be distorted in order to accommodate the passengers. This thickening of the wing would create more resistance than a fair-form fuselage and so secure no advantage. The flying wing will, in time, probably dispense with a tail, but it will still need a nose in order to give the pilot proper operational view and in order to house the tricycle chassis. Thus on civil aircraft the gain may not be worth the sacrifice in other directions.

The low-wing arrangement is likely to give way to the high wing; the latter seems a more practicable arrangement in hot climates, as it protects the passengers from the glare of light reflected off the metal wing. At the same time, there is a certain amount of objection to the high-wing arrangement in that the passengers can see the mechanism of the retractable chassis and the wing flaps; with the low-wing arrangements these components are out of sight and out of mind, and it is possible that the sight of them may lead to a certain amount of uneasiness if there is any delay in their operation.

There is one great advantage of the high wing in that,

by suitable arrangement of the engine nacelles passengers are unable to see the wing tips; this gives the engineer freedom in proving a structure which has reasonable deflections under load; in this way comfort can be assured for the passengers in going through bumps.

Fire Prevention.—We should all like to see reduction in fire risk due to carrying large quantities of petrol, and the obvious line of development here is the diesel engine using fuel with a flash-point at least 200° F. higher than that of petrol. If this development takes long, however, it may be caught up by direct jet propulsion. A good intermediate step towards safety lies in the present tendency to carry the petrol in tanks formed integrally in the main structure.

Conclusions.—In the space of a short article it has only been possible to refer to a few of the factors now undergoing development.

The outlook for the development of the commercial airliner is that it will become more and more mechanised to contribute to the comfort and safety of passengers, and the day is not far distant when commercial aircraft will run to schedule with absolute regularity and safety through any weather.

Getting Down To It

Mr. F. G. Miles, of Phillips & Powis, has his Airliner of the Future Already on the Drawing Board

EDITOR'S NOTE: *In response to "Flight's" request for his views of the commercial aeroplane of the future Mr. F. G. Miles sent us the specification and drawings of his X.2 aeroplane. A brief description was published in our issue of April 21, but it is felt that the letter of this brilliant young designer contains so many explanations of the raison d'etre of the X.2 that our readers will wish to read it. We include also two drawings which show the "lines" of the machine. These are rather necessary to a proper understanding of the Miles interpretation of the "flying wing." Mr. Miles' opinion is as follows:*

IT occurs to me that the best thing for me to do is to say something about the X2, as this is certainly my own developed idea of the trend of large transport design.

The design was completed two years ago, and I have worked at it, on and off, since that time. The principle of the thick, tapered wing has had the attention it required, and my hunch regarding its behaviour has been well borne out in full-scale flight tests which we have been able to carry out.

I am not a great believer in assisted take-offs in the immediate future. The right line seems to me to be to use larger aerodromes, and for long-distance flights to reckon on a run of 500 to 700 yards. On a conventional design the power loading and wing loading involved will give a safe take-off and climb in case of failure of one engine out of four. The same type of aircraft, loaded further and launched by external means, will probably have no margin of safety in the climb at all.

It also appears to me, looking a measurable time ahead, that we shall be wrong to ask too much of the pilot. A step at a time seems enough; we are already asking a great deal, and I personally cannot see that enough attention has been paid to this particular task. I should like to see a national school equipped with Douglas D.C.4s which would aim at the standard of flying required ten years ahead. It would also be used for the development of blind landings, automatic landings, etc., thus serving a dual purpose.

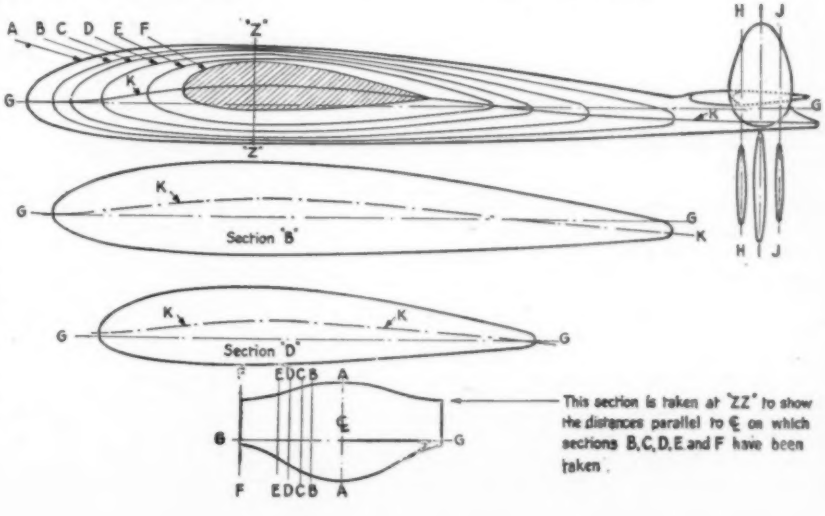
The "X" is a reasonable aeroplane, but, in comparison with other recent projects, it is revolutionary enough. We have gone for a low-aspect ratio so as to minimise engineering and balance difficulties and to provide room for internal stowage in the wings. This latter is helped by the fact that we are using a thickness/chord ratio of wing greater than any used hitherto. The aerodynamic improvements are obvious, but, I contend, not so obviously easy to combine in the first stages of design. The fuselage is all-wing; there is no break between the fuselage and wing, and consequently no interference drag. The aspect ratio of the wing is fairly low and the taper moderate. The combination of this with the deep wing gives the possibility of a light, efficient structure of great stiffness (I need not enlarge on the importance of stiffness with speeds exceeding 300 m.p.h.).

The controls are normal, and bring in no new problems. There is ample room in the wing for the retractable undercarriage, and the engines are accessible in flight. Light and bulky pay-load can be stowed in the wing as well as in the fuselage. The view for pilots and passengers can be judged from the illustration. (The passengers' view is particularly comfortable and good).

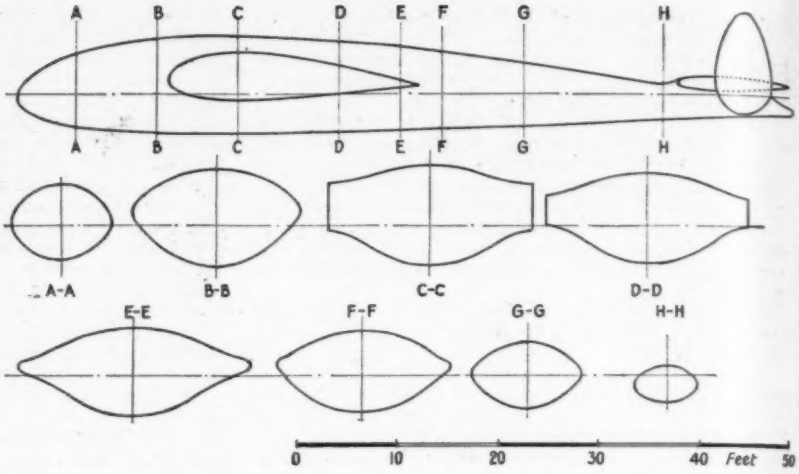
As regards performance, it can be seen from the specification* that I have gone for an aeroplane with a certain degree of universality. It is intended to fly at two wing loadings—28 lb./sq. ft. or 35 lb./sq. ft. The majority of the difference between these loadings would be accounted for by the fuel load required for an Atlantic crossing.

In the latter condition, of 35 lb. loading, the machine is meant to take off in about 600 yards on a prepared runway, climb at a safe rate even if an engine cuts (using feathering airscrews), and to cruise at between 260 and 280 m.p.h. The landing would be very short and easy once the fuel was partly used.

* See *Flight* of April 21, 1938.


A B C D E F
"Z"
G
K
H J
Section "B"
Section "D"
F E D C B A
This section is taken at "ZZ" to show the distances parallel to ℄ on which sections B, C, D, E and F have been taken.

The "lines" of the Miles X2.



The Miles X2: some cross-sections.

Loaded at 28 lb., it is intended for European travel and for the normal aerodrome of to-day. It would be easier to fly than are existing large aeroplanes, and would carry up to 40 passengers plus a large freight load if required. In other respects it would be identical with the other type, and would, in fact, be interchangeable.

We in this country have for years been steadily losing ground against our American competitors, and it is not going to be an easy job to catch up. It is no good trying to build an aeroplane to compete with modern American transport air liners of to-day when we know that our rival aircraft will be at least three or four years in the making. We have to attempt to look ahead, and that is what I have tried to do with the "X." But the design of the aeroplane might be the easier task, as might also be the actual engineering and building. The difficult job seems to me to keep the design, factory and research organisation properly co-ordinated with the requirements of the transport operators, and to develop right from the start a flexible but systematic organisation which would keep design up to date while building proceeded as fast as possible.

There is a great deal of research work to be done, since future designs must obviously include some form of pressure cabin, and must be capable of using large horse-powers without re-design. In the "X2," for instance, we have only arranged for four 1,000 h.p. engines. By the time the aircraft is built it is more than probable that the engines we have in mind will be developed to give 1,250 h.p. for the same installation weight. With this, of course, the performance will be even higher than is given in the specification, and will certainly improve take-off and climb even with the transatlantic load on board.

As another instance of the sort of thing that must be kept in mind, I might mention boundary-layer control. We have done a lot of work on this, and have built a full-scale prototype with which we are now experimenting. I do not say that the aeroplane of the immediate future will use what has become known as boundary-layer suction, but I do say that new designs must keep this possibility in mind.

Exploiting Speed

Opinions of Mr. C. C. Walker, Chief Engineer of the de Havilland Aircraft Co.

IN the very early days of aircraft design it was generally considered that the power expended in mere sustentation was too great in relation to that used for horizontal transport, and that air transport could not compete economically with surface transport, despite its extra speed.

With improved design and increasing speed, the proportionate cost of sustentation has diminished to such an extent that it is no longer a serious item; in a typical high-speed transport aircraft of to-day it is no more than 15 per cent. of the total power employed, and the remaining 85 per cent. is used in propelling the load from place to place and overcoming the friction of its container, together with other incidental losses.

This has been the main direction of advance, and it will probably continue into the future with the further reduction of wing area in relation to load carried. For the purposes of high-speed transport, flying organs could be much reduced in size with advantage were it not for what may be called the terminal problems of take-off and landing.

It may be thought surprising that with the fast air-liner of the present day speed has been achieved without loss of vehicular efficiency. Provided the machine is employed on the relatively long-stage and intensive services for which it is designed, the figure of ton-miles of pay-load or disposable load per horse-power expended does not differ much from that obtained in the older and slower aircraft. In other words, a great increase in speed has been achieved without having to pay for it in running costs.

To forecast the future is more than one would dare to do beyond saying that the prospects are best envisaged in the means that are being examined and tested to-day to reconcile take-off and landing requirements with the conditions of economical and fast transport.

The principal means now being investigated are familiar to us. Assisted take-off by the catapult and the composite aircraft, and devices for taking on fuel when air-borne, are being studied closely. Flaps for reducing landing speeds are already in general use, and are undergoing further development. Control of the boundary layer, by which it may prove possible to delay the stall, thus realising high lift coefficients, is a promising field for research, though it must be remembered that increasing the useful range of angles of incidence will itself introduce further difficulties.

In point of fact, the modern high-speed liner is already an efficient vehicle by comparison with ground transport so long as speed itself is considered an asset.

Probably one of the most useful factors is that the gap between the power that can be taken from an engine at economical weak-mixture conditions for continuous reliable cruising and the higher power that can be taken for short periods for the purpose of take-off tends to increase—a tendency which works in the same direction as the other developments mentioned. Owing largely to the introduction of v.p. propellers, progress has been rapid in this direction, and may continue to widen the gap still more.

THE QUESTION OF COST

"Will There Always be Subsidies?" asks Mr. Sydney Camm, F.R.Ae.S., of Hawkers

I FEEL that in the near future advances in the design of commercial aircraft will be limited to minor developments of existing types. In other words, the Ensign and Empire flying boat class should satisfy requirements for a further five or six years, particularly as the fitting of improved higher powered engines as they become available will increase performance without the need for any very great manufacturing changes.

I am sure the tendency during the next few years will be to consolidate the technical position so far achieved, maximum attention being paid, first, to the requirements of safety and reliability, and, secondly, to improved maintenance qualities. I feel that the manufacture of large commercial airliners will always be more akin to shipbuilding rather than to the mass production of cars.

Any question of development further than five years from now must be tempered by the thought of whether we can continue to neglect cost, and whether the present relatively large subsidies will be maintained.

However, as military requirements demand the production of 2,000 h.p. engines, it seems that one logical development will be towards a larger flying boat class with a specification approximately as follows:—

Engines, 4 × 2,000 h.p.; wing loading, 42.5 lb./sq. ft.; power loading, 12.5 lb./h.p.; empty weight, 54,630 lb.; all-up weight (max.), 100,000 lb.; cruising speed, 235 m.p.h. at 10,000ft. with 50 per cent. max. power; max. speed, 335 m.p.h. at 1,800ft.; range at cruising speed (still air), 3,000 miles.

Disposable load (for 3,000-mile range):—

	lb.
Crew, 5	1,000
Passengers, 40	6,800
Fuel (3,400 gallons)	25,500
Oil (400 gallons)	3,600
Baggage and mail	8,000
	44,900 lb.

Although the wing loading is high at take-off, the power loading of 12.5 lb./h.p. will ensure a reasonable take-off run. It should be noticed that this high power is used only for take off and that cruising is effected at 50 per cent. power, which makes for safety and low maintenance costs.

Developments further than this will, I think, be towards increasing the number of engines rather than to the production of fewer units of higher power, as these latter introduce special problems of which the satisfactory design of a suitable airscrew is probably the most formidable.

With regard to materials, I believe that the comparatively near future will see a trend towards the use of stainless steel for the entire structure, together with an increase in the use of electric welding.

From the aerodynamic standpoint, I consider that it is unlikely that commercial use of extreme developments such as boundary layer control will be made in the near future, although undoubtedly much experimental work on such problems will be undertaken.

THE HURRICANE UNHUSHED

DETAILS of the Hawker Hurricane I single-seater monoplane fighter may now be divulged—in fact, examined, if one happens to be near Glasgow Exhibition, where a partly stripped example of the machine is being shown. The metal girder structure with fabric covering makes this part stripping possible.

The fuselage resembles generally those of the familiar Hawker biplanes, of which enormous numbers have been built, and the wing construction is a development of the well-tried biplane type in that built-up strip spars with bulbous booms are used. The drag bracing is interesting. It consists of members similar to the spars in construction, and running zig-zag fashion between the spars, to which they are attached at both top and bottom booms. The torsional rigidity of the wing is greatly increased in this way.

A neat and immensely strong type of attachment for the fabric covering is employed. Briefly, this consists of channels with their free edges facing outward. The fabric is placed over these channels, and attachment is by a solid strip screwed into the channel, thus gripping the fabric over a large area.

That the speed of the Hurricane is high is generally realised, but not quite so high as indicated by an Air Ministry statement issued in connection with the machine shown at Glasgow. In this statement it is pointed out that flaps increase the speed range to 6 : 1, and a few lines further down the landing speed is given as 60 m.p.h. Simple arithmetic indicates 360 m.p.h., but doubtless the canny Scot will hae his doots.

A considerable number of Hurricanes are now in service. They have Rolls-Royce Merlin II engines rated at 990 h.p. at 12,250ft. and giving a maximum of 1,030 at 3,000 r.p.m. at 16,250ft. Performance figures may not yet be given, but the "plus" of "300 plus" is said to be about 30 for the maximum m.p.h.

Hurricanes are to be fitted with ejector-type exhaust systems, details of which are not available at the moment. The performance should benefit considerably.

Eight fixed Browning guns, a type now used fairly extensively in the R.A.F., are carried in the wings.

COVENTRY'S A.I.D. DINNER

PROOF of the success of last year's dinner and of the growth of the Coventry section of the A.I.D. was the large party—about 350 strong—which assembled at the Rialto Casino, Coventry, last Thursday.

In the unavoidable absence of Mr. F. S. Spriggs (director of the Hawker-Siddeley group), Mr. T. Skipper, manager of the Daimler shadow factory, proposed the A.I.D. He spoke of the excellent co-operation between seniors and juniors within the A.I.D. itself, and paid them the compliments which seem to be so unanimously expressed by all those contacting the A.I.D. that we are beginning almost to believe them.

Mr. Skipper said that in theory, inspection should not be necessary, but just as police were to prevent rather than apprehend crime, inspection should be to prevent rather than detect mistakes. He thought that inspection and production would never quite see eye to eye, but that constructive criticism was a good thing.

Lt.-Col. H. W. S. Outram, C.B.E., Director of Aeronautical Inspection, responding, said that he had regarded the first Coventry A.I.D. dinner, at which he was also present, as a happy experiment; such functions were admirable in that they allowed people to talk frankly and freely, uninfluenced by works or office surroundings.

Col. Outram was very pleased to see Capt. Tom Greening at the dinner. [Capt. Greening was head of the A.I.D. Midland area during the War.]

He thanked the firms for their co-operation and said that *real* production was to come during the next twelve months.

Mr. S. J. Norton, the chairman, thanked the guests for coming, and Lt.-Col. J. A. Cole, O.B.E., J.P., chairman of Humber, Ltd., and Mr. H. H. Harley, director of the Coventry Gauge and Tool Co., Ltd., replied suitably to that sentiment. Col. Cole thanked the A.I.D. for their tact, which helped to oil the wheels of production; and Mr. Harley, during an amusing few words, said that when asking his wife's permission to attend the dinner he was asked if the A.I.D. was another secret society. Did A.I.D. stand for Ancient Institution of Druids?

SUB-STRATOSPHERE

"HIGH-ALTITUDE transport aeroplanes designed with pressure cabins for long-distance passenger service in the sub-stratosphere (20,000ft. to about 30,000ft.) are under construction in practically all the major aircraft factories. Two of these sub-stratosphere liners, the Boeing Model 307 transport and the Douglas Model DC-4, will be flown this summer. The most interesting feature of these developments is that they are production jobs, and not entirely experimental. However, the results of nearly twenty years of research, mostly by the Air Corps at Wright Field, culminating in the Air Corps' Lockheed XC-35 sub-stratosphere aeroplane, has been available as the basis for commercial design. The success of the XC-35, which has been flying regularly for nearly a year, as a practical passenger aeroplane for service at 30,000ft. altitude, has undoubtedly been the impetus to the present commercial design trend."

This paragraph from the lecture delivered to the Royal Aeronautical Society on April 21 by Prof. J. E. Younger, of the University of California, should give us something to think about. Not only has America two machines designed for high altitude flying which will be in the air this year, but nearly all her main aircraft factories are producing such machines. The second important point is that the research which has made this progress possible was begun as long ago as 1920.

Prof. Younger dealt with some 20 principal problems encountered in the design of aeroplanes for passenger service at heights of 20,000ft. to 30,000ft., and although the main problems could be said to have been solved, he regarded the work done as only an "entering wedge," and pointed out that there was an enormous amount of work yet to be done before sub-stratosphere flying could become daily routine.

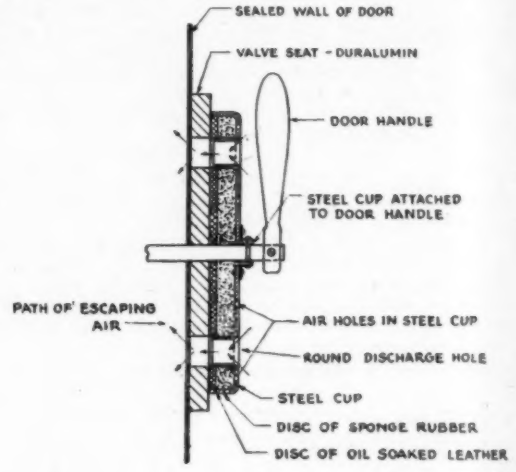
For the purpose of his lecture, Prof. Younger classified the main engineering problems into the following:—

1. Structural problems; such as type of structure, strength, airtight joints, expansion, etc.
2. Mechanical problems; such as door and window design, control glands, de-icing, de-frosting, etc.
3. Air flow regulation; control and safety valves, free from noise and possibility of freezing, etc.
4. Physiological; such as volume and pressure required, pressure fluctuation permissible, etc.
5. Air supply; superchargers, mechanically or turbo-driven.
6. Fuel supply problems.

Space does not, unfortunately, permit of giving in detail the lecturer's account of the history of the development of sub-stratosphere aeroplanes, but it is interesting to recall that the work was begun by the U.S. Army Air Corps at McCook Field in 1920 when an oval steel tank was fitted into the fuselage of a De Havilland biplane and a wind-driven gear supercharger provided pressure for the tank. Investigations were revived at Wright Field in 1935. This work was completed in the spring of 1936, and the Lockheed XC-35 experimental aeroplane was completed by that company in the spring of 1937. The XC-35 has done a lot of flying since and has provided valuable data.

In the meantime T.W.A., with Mr. D. W. Tomlinson in charge, were conducting flight tests with the object of choosing the best method of supercharging at 20,000ft. and above, to equip an engine for rated power operation at 30,000ft., to determine the actual increase of speed with altitude as a check against theory, and to determine by overweather cross-country flights the force and direction of winds.

Structure.—Prof. Younger examined the different types of structure likely to be suitable for pressure cabins, and came to the conclusion that the standard type of semi-monocoque fuselage as used in most modern aircraft was the most logical form of construction. The fuselage in this case should be of circular cross-section for minimum weight and should have ends as nearly hemispherical as possible. He thought little weight need be added to a fuselage of 6ft. to 10ft. in diameter for internal pressures giving 10,000ft. conditions at 30,000ft., a pressure difference of approximately 5 lb./sq. in.



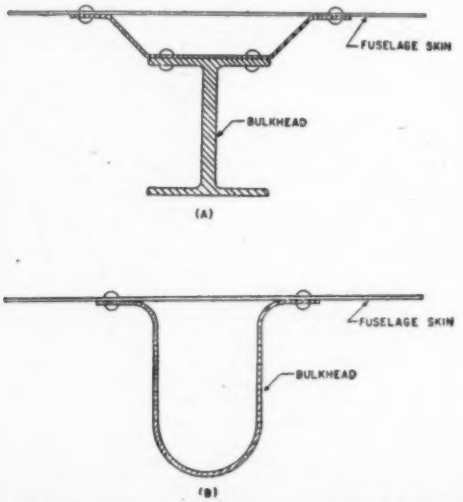
A release valve incorporated with door handle to relieve pressure before door is opened.

On the question of design factors, Prof. Younger said it seemed to him illogical to use a fixed design factor of two and a half times the differential pressure, as with safety valves it would be almost impossible to assume that a pressure in the cabin of two and a half times the normal design pressure could ever occur at the same time that the maximum aerodynamic design conditions were being realised. He recommended that the basic design pressure only should be used in connection with the usual load factors required in the structural design of the aeroplane. For a commercial design he recommended a design pressure factor of one and a half to two times the basic differential pressure. For instance, in an aeroplane designed to fly at 25,000ft. with sea level pressure maintained inside the cabin, the differential pressure would be about 8.2 lb./sq. in., and for the design of the cabin this difference should have to be multiplied by a factor of 1.5 or 2.

The problem of airtight joints in the shell plating of the fuselage was not difficult. The type of joint used in flying boat hulls was considered adequate. This joint, of course, is made by placing a strip of fabric soaked in marine glue or other sealing compound between the two edges of the metal sheets. Prof. Younger considered that if necessary the rivets could be divided into two classes, the larger for strength and the smaller for sealing. If a finished joint leaked slightly a coat or two of marine glue or other bitumastic non-drying paint would usually make the joint satisfactory.

Expansion Problems.—Expansion of the skin under pressure was not serious and could be calculated quite accurately. Bulkheads produced the most serious problems, and the lecturer suggested as an alternative to the hemispherical type, which was difficult to make, a conical type with flexible attachment to the fuselage skin. Forms of bulkhead attachments that had been found satisfactory are shown in one of the illustrations.

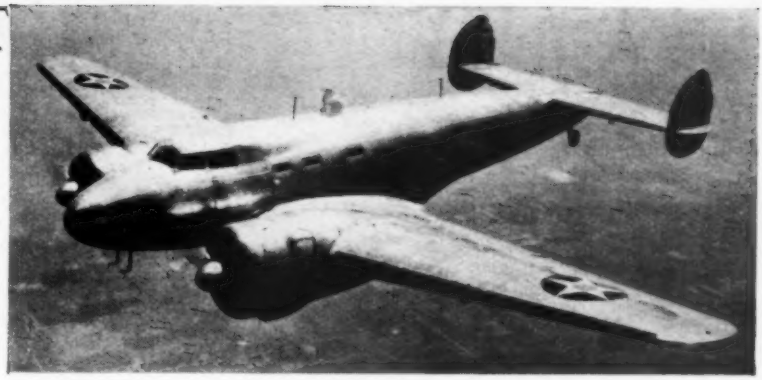
The question of the possibility of an explosion occurring should the fuselage skin be punctured for any reason naturally presented itself for consideration. As this could only happen when the stresses were near the ultimate strength, the lecturer



Bulkheads designed to allow for expansion of the skin.

EVELOPMENT

An American Engineer Records the Progress Made in the United States : Prof. J. E. Younger's R.Ae.S. Lecture



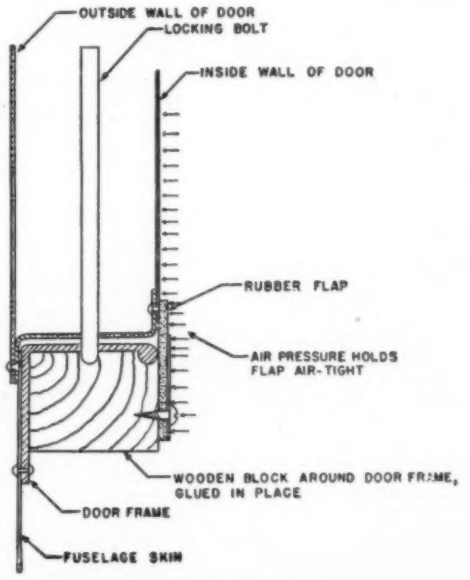
The Lockheed XC-35 experimental monoplane with which the flight tests were made. It is equipped to operate at 30,000ft.

thought the possibility of this happening very small.

Referring to the fact that most artists' sketches of proposed stratosphere aeroplanes showed circular windows, Prof. Younger said there did not appear to be any obvious reason why round windows should be used. Narrow, rectangular windows arranged longitudinally in long narrow strips were most desirable from a structural and practical standpoint. He thought that individual windows might be six inches high and twelve inches long. After investigations into the bursting strength of laminated plate-glass windows, it was recommended that a modulus of rupture of 4,500 lb./sq. in. should be adopted.

Another problem was that of designing suitable doors for a pressure cabin. The type adopted in the XC-35 was held in place by 14 bolts actuated simultaneously by a handle on a master cam. The handle could be turned through approximately 90 deg. before the cam, which operated in a slot, made proper contact for withdrawing the bolts. The object of this was that during the process of turning through 90 deg. a disc on the inside of the door rotated, thus bringing air holes in the disc and the valve seat into line, and thus releasing the air from the cabin. After a number of trials it was found that air leakage between the disc and its seat could be prevented by using glazed leather $\frac{3}{16}$in thick soaked in oil and held in place by a pad of sponge rubber.

There was a certain amount of disagreement concerning whether doors should open inwards or outwards. Prof. Younger thought that the logical answer was that there should be two doors, one opening inwards and one opening outwards. The outward opening door required fairly intricate operated mechanism which might be deranged in case of a crash, while the inwardly opening door would require no mechanism for its operation and need only be held in place loosely against a gasket of soft rubber by small spring clips. Glass windows could be sealed in the same manner, but it was advisable to separate the glass from the metal structure and the clips must not press heavily in order that distortional stresses should not be transmitted from the structure to the glass. He recommended that soft rubber should be used, as this allowed a more even distribution of stress in the glass.



Airtight seal of cabin door.

Control Glands.—Here the principal problem was that of hermetically sealing the exits of control wires, tubes, etc., through the walls of the cabin. Two types of motion were involved, rotation and sliding. The sealing of a gland for a torsion shaft was very simple and one of the illustrations shows the simple gland used in the laboratory in connection with the supercharger valve control. Another illustration shows a gland which had proved satisfactory for either rotation or sliding, even at very low temperatures and when sprayed by a water mist so as to cover the gland completely with ice. Other ways of constructing such glands were obvious and the lecturer illustrated a bellows arrangement. This gland, by the way, was designed for use in the investigations but was not constructed as the other designs mentioned were simple, light and safe.

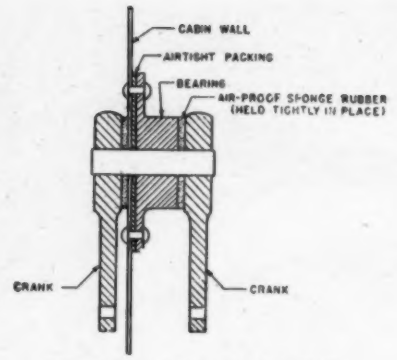
Safety Valves.—The tendency to flutter of the ordinary spring operated valve suggested that a special device would have to be developed. However, a simple type of spring loaded valve, shown diammetrically in an illustration, was constructed and to everyone's surprise proved entirely satisfactory This valve was, of course, an outwardly opening one. It was necessary to have also an inwardly opening one in order to make sure that the pressure on the inside of the cabin could never become less than that on the outside, since otherwise the cabin walls might be crushed inward. The inwardly opening safety valve was of very simple type and consisted of a soft sponge rubber flap hung like a curtain on the inside of the cabin over several small holes in the side wall.

Discharge Valves

Apart from the safety valves, it is, of course, necessary to have a valve which discharges the pressure air from the cabin. Such a valve should maintain a constant pressure inside of the cabin regardless of the barometric pressure on the outside and should be free from any possibility of freezing. The simple valve shown in an illustration fulfilled these two conditions satisfactorily for fairly high differential pressures but at low differential pressures the spring effect of the sylphon bellows caused a variation of about half pound per sq. in., when the differential pressure was changed from about one pound per sq. in. to 5lb. per sq. in. This valve had the disadvantage that it would not close readily when the pressure in the cabin was reduced. For instance, if the pressure was 5 lb. per sq. in. in the cabin and the supercharged air supply was cut off suddenly, the discharge valve would allow the pressure to drop to 3 or 4 lb. per sq. in. before it closed.

An electrically operated valve is shown in another illustration. Such a valve was installed in the XC-35 and gave fair service but considerable refinement was still necessary.

Regulation of the quantity of air flowing into the cabin was necessary. If the supercharging unit was separate from the main aero engines, the regulation could be effected by regulating the speed of the supercharger. This would not be possible if the supercharger were operated by the aero engines, and in that case it would be necessary either to regulate the



Simple gland for a torsion shaft.

amount of intake air by by-pass valves or to allow the full capacity of air from the supercharger to flow into the cabin and make proper adjustments in the discharge valve mechanism to provide for changing volumes. The discharge valve should have sufficient capacity to care for the entire maximum discharge without an appreciable rise in pressure.

Provision had to be made for the possible failure of the superchargers. Check valves should be installed in the line to prevent air flowing out of the cabin into the superchargers and for the automatic spraying of oxygen from emergency tanks. This equipment could be so arranged that one of several oxygen bottles could have its valves so adjusted that it opened at a pressure equivalent to 16,000ft., the next bottle opening at 17,000ft., and so forth.

Frosting and Icing

Icing.—A report on the XC-35 stated that the problem of removing ice from the pilot's windows had not been solved successfully. The glass was ⅜in. thick, and it was found difficult to supply enough heating to the inside of the glass to melt the ice on the outside.

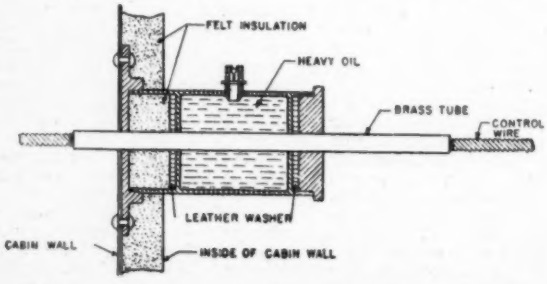
During the experiments at Wright Field it was found that the metal surfaces of the pressure cabin quickly became frosted. In a period of four to five hours this frost in some cases attained a thickness of as much as ¼in. It was discovered that where felt insulation was pressed firmly against a cabin wall there was no tendency to form frost, but where the insulation did not press firmly against the wall, the formation of frost was more excessive than in places where there was no insulation. This indicated that the cabin insulation should be glued firmly to the outer skin with an elastic glue.

On the subject of air supply, Prof. Younger stated that it seemed probable that the required amount for a pressure cabin might be fixed at about 10 cu. ft. per minute, which was considerably less than the 20 to 30 cu. ft. a minute per person considered necessary for schoolroom conditions.

Test results had shown that, generally speaking, no harm was caused to the occupants of a pressure cabin, even if a pressure of 8lb./sq. in. was suddenly reduced to atmospheric pressure at altitude conditions up to 25,000ft.

The problems of the temperature and humidity control were fundamentally the same as for the standard passenger aeroplane, but care must be taken to see that the air discharged into the pressure cabin from the supercharger did not become contaminated with oil mist.

Supercharging.—For safety at least two units should be used. They could be operated in series if means were provided for changing over to parallel operation, and the capacity of each should be about 75 per cent. or more of the required capacity for the pressure cabin.

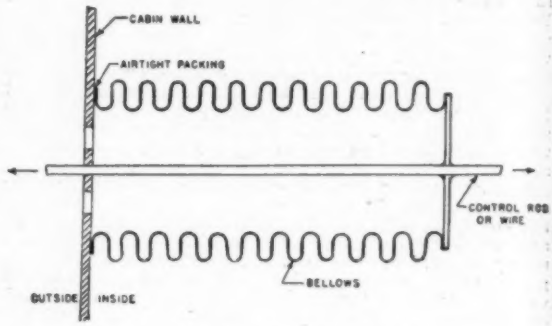


This type of gland proved satisfactory for both rotating and sliding shafts at low temperatures.

Two types of supercharger had been developed, the gear-driven and the exhaust-driven. Theoretically and practically, the exhaust-driven turbine offered advantages over the gear-driven type. The introduction of constant speed airscrews might, however, change the balance in favour of the mechanically driven type, since, with constant speed airscrews, it could be geared directly to the main engine and a small speed range assured. Steps had been taken to get firms in the industry interested in a mechanically driven cabin supercharger.

In connection with the fuel supply, Tomlinson, of T.W.A., had come to the conclusion that fuel pumps must be completely drowned and preferably electrically or hydraulically driven. They should be located in the bottom of the tanks. Evaporation losses were bound to occur and for extensive operation at sub-stratosphere heights it would be necessary to develop either a less volatile fuel or to put the pressure in the fuel tanks under the same pressure as that in the cabin, although that was definitely undesirable.

Capt. Johnson had come to the conclusion that there should be no surplus fuel delivered to the engine, and the speed of the fuel pump must be so governed that the pump delivered the exact amount demanded by the engine at a given pressure. This was accomplished on the XC-35 by the use of a variable speed hydraulic motor, the speed being governed by the fuel pressure.



A bellows type of gland.

THE DISCUSSION

THE discussion was opened by MR. A. H. R. FEDDEN, who expressed his appreciation of the great amount of detail work done by America on the subject of stratosphere flying. There were three questions he would like answered; was 18,000ft. high enough for over-weather flying, how much of extra cabin weight would be due to structure, and how much to equipment and what about oil fumes in the cabin.

PROF. YOUNGER replied that the Lockheed experiments had been carried out at 30,000ft., but that the T.W.A. experiments had shown that one could get bad weather at 18,000ft. Tomlinson had found that one could encounter high air velocities at 30,000ft. The structure weight was almost negligible. The greatest addition came from the windows. He thought one might say that the structure weight increase amounted to only 1 per cent., but that the equipment would account for about 1,000 lb. extra. He agreed that the air from the supercharger had to be thoroughly conditioned, and pointed out that only 10 per cent. of the engines' air requirement was needed for the cabin.

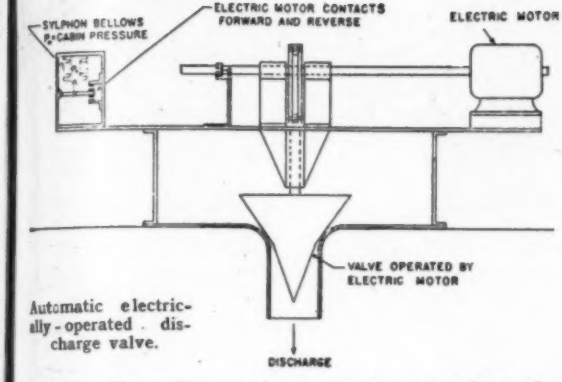
CAPT. C. F. UWINS wanted information concerning any special precautions taken against unequal expansion of control cables, etc., and also asked if the Americans had any trouble with corrosion. He also would like to know at what percentage of ceiling height an engine could be run continuously, how the wireless reception had been found at these great heights, and finally, whether the whole thing was worth while.

PROF. YOUNGER replied that the question of unequal expansion was calculable and he had heard no complaints. One would expect corrosion due to frosting, but he thought frosting could be prevented. He had no data on corrosion. Wireless reception seemed to be good. As regards engines, the chief trouble was in connection with the evaporation of the fuel. Whether or not high altitude flying was worth while depended on circumstances. In America it so happened that the distances were just about right, and, moreover, they had mountains to clear.

SQN. LDR. F. R. D. SWAIN, A.F.C., who held the world's altitude record until it was beaten by Flt. Lt. M. J. Adam, said his experience was that one was liable to encounter clouds up to about 33,000ft., but that one was clear of them at 35,000ft.

FLT. LT. M. J. ADAM said he was glad to learn that the structure weight increase was not great because judging from his own experience, he would certainly say that pressure cabins were a great deal more comfortable than pressure suits.

LORD SEMPILL asked about any difficulties with the icing up of the aircraft structure itself, and was told in reply that the lecturer did not have the information but that it was available.



Automatic electrically-operated discharge valve.

MR. D. L. HOLLIS WILLIAMS thought our aim ought to be to offer sea level conditions at all heights as there were many travellers who suffered considerably at a height of even a few thousand feet. With reference to heating the cabin air, he thought it might be possible to get the heat direct from the pressure rise.

PROF. YOUNGER agreed that maintenance of sea level conditions would be desirable, especially for sleepers, as passengers who were asleep often suffered considerably from changes in altitude during a night flight. The heat by pressure rise was not sufficient, and additional heat had to be supplied.

PROF. G. T. R. HILL had been struck by the simplicity of the solutions found for the various problems. He thought pressure cabins ought to be made easily airtight. Flying boat hulls were, and they had to stand much higher pressures. He did not appear to agree with the lecturer on the subject of windows, and thought the circular type was right and logical. He expressed the view that the saving in fuel which arose from flying high would soon make up for the extra weight, and reminded the audience that when the retractable undercarriage was suggested there were many who said it was too heavy and complicated. Yet it was now in universal use. He regretted that the lecturer had made no mention of the work done by Farman in flying, work which anti-dated the American.

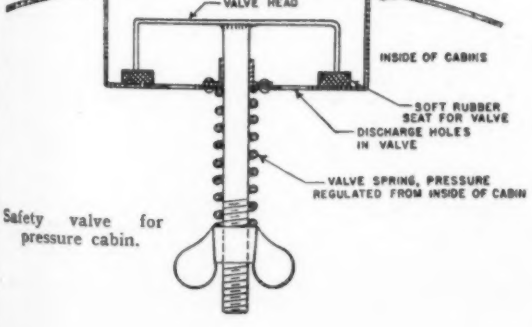
AIR COMDRE. R. H. VERNEY, C.B.E., Director of Technical Development at the Air Ministry, pointed out that in Europe at any rate one encountered cloud below 8,000ft. on 50 per cent. of the days of the year, and that it was an advantage to get above them in bad weather.

PROF. YOUNGER explained that he had limited his paper to the work done in the U.S.A., but that this did not mean that he was either unaware or unappreciative of the work done by others, including the Farmans. If it came to that, patents were taken out by Louis Breguet many years ago on all the essential features of the high altitude aeroplane.

MR. F. M. SMITH, project engineer of the Lockheed Co., was at this point asked to reply to some of the questions of which he had particular experience. He said that in one flight at 20,000ft. with normal rigging the elevator control went slack. Afterwards they got over the trouble by so rigging the cables that they were very tight on the ground. On one flight of the Lockheed there was a national pick-up on America's radio, and they broadcast a description of the flight from 20,000ft. This was approximately at noon, and they learned afterwards that the reception had been perfect throughout the U.S. The noise in the XC-35 was less than in the Electra, a fact which he put down to the heavier plating used and to the airtightness of the cabin, but also possibly to the pressure itself.

MR. FRANK RADCLIFFE asked whether on flights of five hours' duration or so, ten cubic foot per hour per passenger was sufficient.

To this MR. SMITH replied that they had found it enough in the Lockheed. In one three hours' flight at 20,000ft. the temperature was 65 to 70 deg., and they worked comfortably in shirt sleeves.


DISCHARGE HOLES IN CABIN WALL
VALVE HEAD
INSIDE OF CABIN
SOFT RUBBER SEAT FOR VALVE
DISCHARGE HOLES IN VALVE
VALVE SPRING, PRESSURE REGULATED FROM INSIDE OF CABIN

Safety valve for pressure cabin.

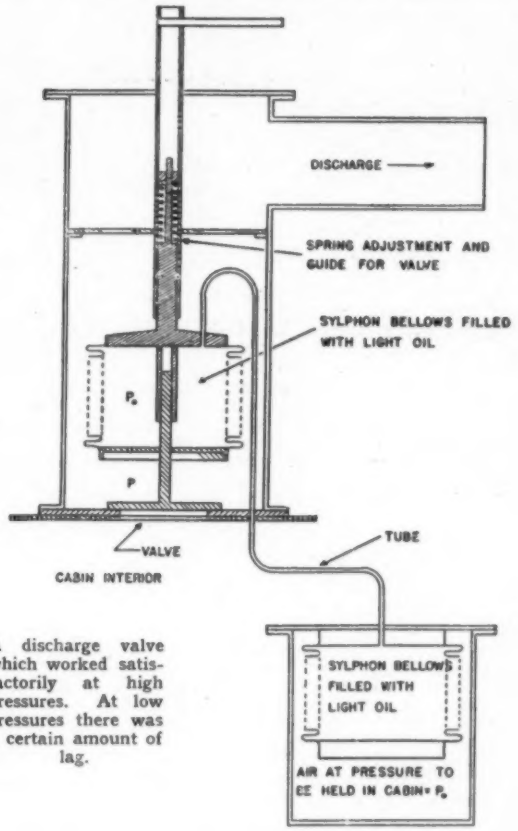
MR. M. L. BRAMSON reminded the audience of the fact that almost every great development of recent times had been turned down by most speakers at Society lectures as not being worth while, and said they ought to be careful that history did not repeat itself in connection with pressure cabins

MR. AMHERST VILLIERS stated that Mr. Tomlinson had found a 30 per cent. increase in speed at height. He wanted to know if the exhaust driven blower was sufficient for supplying the cabins when the engines were throttled.

The lecturer replied that he thought there should be a separate supercharger for the cabin, and thought it might be possible to develop a bellows type which could be placed in the wing. One would then get absolutely pure air.

MR. SMITH replied that in the XC-35 the skin was rather rough, and they had made no attempt at getting extra speed, but it might be interesting to mention that at 20,000ft. the speed of the Electra was 220 m.p h., and that of the XC-35 243 m.p.h

MR. K. J. R. WILKINSON asked what was the limiting height, and whether the Americans had had any trouble with ignition. To this



A discharge valve which worked satisfactorily at high pressures. At low pressures there was a certain amount of lag.

the lecturer replied that the limitation in height was set by the engines. They had had a certain amount of trouble with sparking and also with the petrol supply.

MR. FISCHELES enquired about icing troubles, and was told that there was no icing at 30,000ft. as there was no moisture, but that ice could occur on the way through the lower layers.

CAPT. J. LAURENCE PRITCHARD, referring to Mr. Bramson's remarks, said he would point out that not everything that was good had come from America. For instance, one very good product of the same name as the lecturer's came from this country. In connection with this altitude flying he was interested to know how much it was going to cost and who was going to pay. Every passenger carried in an aeroplane at present was largely paid for by people on the ground who never flew at all. He would like to know if the Americans had found that larger control surfaces were necessary for high-altitude flying.

MR. F. HANDLEY PAGE, who was in the chair, added his voice to those who had been asking for a profit and loss account. He wondered what was the position of pressure cabins in relation to military aircraft as bombs required holes through which they could be dropped. Perhaps it would be possible to keep the crew in a small cabin, leaving bombs and such like at atmospheric pressure.

PROF. YOUNGER pointed out that the title of his paper had been carefully chosen, and that it meant all it said. (The title was "Engineering aspects of commercial high altitude flying" and the sub-title "With particular reference to recent development in the U.S.")

After the lecture the Royal Aeronautical Society gave a small informal dinner to Prof. Younger at the Park Lane Hotel, at which were present representatives of the industry and the Air Ministry.

SERVICE AVIATION

"Flight" photograph.

Royal Air Force and Official Announcements : Fleet Air Arm News : Military Aviation Abroad

(Left) A general impression of the scene at Northolt on Wednesday of last week.

M.P.s See the Service

MEMBERS of the Parliamentary Air Committee and other M.P.s were taken to Northolt on Wednesday morning of last week to inspect old and new Service types in illuminating juxtaposition. The official purpose of the display was to demonstrate recent types of R.A.F. bomber and fighter aircraft, but not a solitary Blenheim or Wellesley put in an appearance, though there was a park of sample machines featuring the Hurricane, Gladiator, Fury, Demon, Battle, Harrow and Whitley.

It is more than likely that it was decided to disrupt Service routine as little as possible by centring the whole affair around equipment immediately available at Northolt. No. 111 (F.) Squadron was on the spot with its Hurricanes, which were, of course, absolutely indispensable; then there were the obsolescent but turret-equipped Demons of No. 23 (F.) Squadron by way of contrast, and presumably to indicate that two-seater fighters are with us to stay (though if this is correct a replacement type must soon be forthcoming in quantity); the Station H.Q. Flight weighed in with a Gladiator and a spatted Kestrel V Fury; and there were six Battles (52 Squadron) and a trio of Harrows (214 Squadron) which seemed so at home as to lead one to believe that they had other business at Northolt. One's guess is that they are co-operating with No. 111 Squadron in evolving new fighting tactics to suit the peculiar qualities of the new single-seater monoplanes.

A lone Whitley dropped in (metaphorically) and attached itself to the static sample display just before things began to happen.

The Westminster contingent, after browsing at leisure round the parade of thirty-three machines, coagulated on the tarmac to experience the somewhat doubtful pleasure of watching high-speed aeroplanes—individually and collectively—charging over the aerodrome towards the spectators and going into their peculiar, but generally cacaphonous, initial climbs more or less overhead.

The individual-aerobatic Fury, with the throttle far enough through the gate to admit an impressive poundage of boost, gave its well-known imitation of a super-sports lift in a Brobdingnagian skyscraper. When aeroplanes like this finally leave the Service they will take from us thrills which have hushed tremendous crowds and made hard-bitten pilots coo with delight.

A typically searing dive by way of a prologue built up speed for a series of decidedly upward rolls. Subsequent manœuvres gave an uncompromising exposition of the Fury's aerobatic qualities, and were rounded off by a circuit with the stick well back.

Interest was then transferred to the person of Air Vice-Marshal E. L. Gossage, who commands No. 11 Fighter Group, and who gave an admirable outline of the events which might lead up to a quick getaway by a fighter squadron. Visitors seemed duly impressed to learn that officers of No. 111 (F.) Squadron are required to leave their telephone numbers when away from the aerodrome. When the Air Vice-Marshal reached the appropriate point in his narrative a bell rang, and the Hurricane pilots in their grotesque microphone masks and snowy suits legged it for their respective mounts. In seconds everything was shuddering to the merciless thunder of Merlins. A Hurricane wide open on the ground becomes most impatient, and when taxying (at suitable reduced throttle opening) allows itself to be driven like a racing car.

In formation across the aerodrome the squadron awaited the final command to take off while there was widespread parliamentary concentration on the second hands of watches. The leader of the formation synchronised his watch with Control by R/T., and soon the green and brown Hawkers were away on interception bent.

Five Demons of No. 23 (F.) Squadron, with de-rated Kestrel V engines and Nash and Tompson gun turrets then made

"Flight" photograph.

A flight of Hurricanes of No. 111 (F.) Squadron gets away over three representative fighter types — Hurricane, Gladiator and Demon I (with turret).

their presence felt by diving off an echelon formation for what is commonly known in the Service as a dive bomb. Keeping on each others tails they mauled the target from north, south, east and west, and theoretically emptied their racks of eight twenty-pounders apiece.

Then three Harrows and six Battles flew past in dignified fashion followed by nine Demons with the Hurricanes in full cry behind. This was arranged to demonstrate comparative speeds of old and new types of fighters. It was all rather touching, particularly when one recalled some happy hours in the back seat of the Demon in the days when it was top of its class.

The Hurricanes proceeded with a very creditable line abreast and a Vic to show that, in spite of bumps, close high-speed formation work is possible with the new equipment.

An individual Hurricane pilot then showed the handling qualities of the type without resorting to aerobatics. His astonishing slow flying was, perhaps, not so widely appreciated among the parliamentary visitors, but one gathered that the tractability at the lower end of the speed range greatly impressed M. Pierre Beranger, Vice-President of the Aeronautical Committee of the French Chamber of Deputies, who was present.

The party subsequently inspected the station buildings.

The Harrow's Flaps

THERE have been cases when the pilots of Handley Page Harrows, flying at high altitudes and in cloud, have used their flaps to reduce speed. The Air Ministry points out that the hand-pump-operated flaps on the Harrow are not expected to function at heights above 10,000ft.

Additional Orders

An order has been placed for Merlin engined Whitleys, to be called Whitley IVs. Pictures of an experimental machine equipped with Merlins, probably Xs with two-speed supercharging, appeared in *Flight* of March 10.

Performance with Merlin Xs, which each give 1,000/1,040 h.p. at 2,500ft. and 925/965 h.p. at 13,250ft., should be considerably improved. Tiger-engined Whitleys have a speed of about 215 m.p.h. at altitude on a total of 1,620 h.p.

The forward position of the heavier Rolls-Royce engine nacelles may necessitate other modifications.

Additional orders, incidentally, have been placed for Avro Ansons and Supermarine Walruses.

Designation of Bomber Types

IT has been decided to omit the words "light," "medium" and "heavy" from the designations of the various classes of bomber aircraft. This system of nomenclature was, of course, only of temporary value, and would become virtually useless on the introduction into the Service of very large four-engined machines.

Although the obsolescent Heyford has hitherto been in the "heavy" category, the probability is that its load is not so big as that handled by some of the new twin-engined machines provisionally described as medium bombers.

R.A.F. Staff College

THE following officers passed the R.A.F. Staff College Qualifying Examination, which was held in January. The selection of officers to attend the next Staff College course will shortly be made, and their names will be promulgated this month:—

Royal Air Force

Squadron Leaders:—Adnams, A. G., Beamish, C. E. St. J., Blackden, V. Q., Bufton, S. O., Campbell, J. H. McN., Emms, G. D., Field, R. C., Franks, J. G., Grierson, C. McK., Hammond, A. V., Harston, R., Harvey, G. D., Johnson, J. C. A., Jordan, R. C., Lewis, E. C., Louden, J. A. H., McKenna, J. F. X., Martin, H. H., Merton, W. H., Mole, E. L., Moore, L. P., Morshead, V. D., Pickles, K. F. T., Thomson, P. G.

Flight Lieutenants:—Barrett, G. G., Bird, I. C., Burke, H. St. G., Cartmel, B. S., Cauthery, R. P., Cleland, R., Cole, F. C., Cooper, W. C., Crosbie, L. J., Dale, H. R., Earle, A., Elliott, W. J. B., Harrington, C. F., Harrison, R. B., Hebden, W. S., Jefferson, J. N., Kippenberger, R. L., Lowe, E. N., Macdonald, D. M. T., Rodgers, A. M., Sadler, W. R., Vintras, R. E. de T., Whitehead, J., Wicks, F. F.

THE following dominion officers also passed the examination:—

Royal Australian Air Force

Flt. Lts. Carr, A. G., and Hely, W. L.

Royal Canadian Air Force

Flt. Lts. Coleman, S. W., and McBurney, R. E

Royal New Zealand Air Force

Sqn. Ldr. Olson, E. G., Flt. Lt. Newell, F. R.

Royal Air Force Gazette

General Duties Branch

The following F/O.s are promoted to the rank of Flt. Lt. with effect from April 1 and with seniority of the dates stated:—J. C. Bevan, G. W. Peel (A./Flt. Lt.) (July 1, 1937); A. R. Fane de Salis, B. J. R. Roberts (A./Flt. Lt.) (January 1); W. P. Whitworth (January 2).

The following F/O.s are promoted to the rank of Flt. Lt. on the dates stated:—R. H. Waterhouse, E. L. Colbeck-Welch (April 1); J. L. Barker (April 2); A. A. de Gruyther (April 22).

Group Capt. G. B. Dacre, D.S.O., is granted the acting rank of Air Commodore (unpaid) (March 26); F/O. P. W. Stansfeld (Capt., Royal Tank Corps) is granted the honorary rank of Flt. Lt. (October 14, 1937); Flt. Lt. G. D. M. Blackwood is transferred to the Reserve, Class A (April 25).

Chaplains Branch

The Reverend A. W. Hopkins is granted a short service commission with the relative rank of Sqn. Ldr. with effect from April 13.

The following Chaplains become entitled to the relative rank of Group Capt. (March 6):—Reverend J. F. Cox, M.C., M.A., Reverend J. A. Jagoe, M.A.

Memorandum

Flt. Cadet A. W. F. Whitmore is granted an honorary commission as Sec. Lt. with effect from date of demobilisation, April 30, 1919.

Royal Air Force Reserve

General Duties Branch

Sqn. Ldr. A. Rowan (R.A.F., Ret.) is granted a commission as F/O. (Honorary Sqn. Ldr.) in Class C, with effect from March 14.

Royal Air Force Appointments

General Duties Branch

Wing Commanders.—C. L. King, M.C., D.F.C., to R.A.F. Station, Catterick; to command 11.4.38. F. Wright, to R.A.F. Station, Bassingbourn; to command, 28.3.38. J. T. Paine, to No. 7 A.T.S., Acklington; to command, 1.4.38.

Squadron Leaders.—P. G. Scott, to H.Q., No. 3 (B.) Group, Mildenhall; for Air Staff (Intelligence) duties, 4.4.38. J. W. F. Merer, to H.Q., Bomber Command, Uxbridge; for Navigation duties, 15.4.38. H. F. Luck, to H.Q., No. 30 (Balloon Barrage) Group, London; for Air Staff (Maintenance Liaison) duties, 2.4.38. H. G. Wheeler, to Deputy Directorate of Intelligence, Air Ministry, 11.4.38. I. Hodgson, to H.Q., No. 24 (Training) Group, Halton; for Personnel Staff duties, 1.4.38. R. J. A. Ford, to H.Q., Bomber Command, Uxbridge; for Administrative (Air Staff) duties, 8.4.38. J. A. H. Louden, to Deputy Directorate of Operational Requirements, Air Ministry, 14.4.38. E. A. Jones, to H.Q., No. 5 (B.) Group, Grantham; for Navigation duties, 8.4.38. Act. Wing Cdr. A. H. H. MacDonald, to Special Duty list; on appointment as Air Attaché, Prague, 28.3.38. C. A. Horn, to H.Q., R.A.F., Palestine and Transjordan; for Air Staff duties, 24.3.38. R. A. T. Stowell, to No. 55 (B.) Squadron, Dhibban, Iraq; to command, 23.3.38. E. S. Burns, to Directorate of Training, Air Ministry, 8.4.38. P. G. Thomson, to No. 8 F.T.S., Montrose, 25.3.38.

Flight Lieutenants.—S. E. R. Shepard, E. W. Whitley, to H.Q., No. 26 (Training) Group, Hendon, 4.4.38. P. A. Hunter, to C.F.S., Upavon, 4.4.38. T. U. Rolfe, to No. 217 (G.R.) Sqn., Tangmere, 1.3.38. F. M. Loudon, to No. 8 F.T.S., Montrose, 4.4.38. C. W. Grannum, to No. 11 F.T.S., Shawbury, 1.4.38. E. G. Granville, to No. 3 A.T.S., Sutton Bridge, 11.4.38. G. L. Best, to Directorate of Repair and Maintenance, Air Ministry, 28.3.38. P. S. Gomez, to No. 29 (F.) Sqn., Debden, 5.4.38. J. Cherrill, to R.A.F. Station, Ismailia, 21.3.38. W. R. Beaman, to No. 70 (B.T.) Sqn., Dhibban, Iraq, 24.3.38. G. N. Snarey, A.F.C., to H.Q., No. 12 (F.) Group, Hucknall, 24.3.38. P. S. Salter, to C.F.S., Upavon, 4.4.38.

Equipment Branch

Flight Lieutenant.—L. W. Park, to "A" Maintenance Unit, Hendon, 1.4.38.

Accountant Branch

Flight Lieutenants.—K. E. M. Holmes, to No. 208 (A.C.) Sqn., Heliopolis, Egypt, 23.3.38. T. P. E. Campbell, to R.A.F. Station, Thorney Island, 5.4.38.

Medical Branch

Wing Commanders.—B. F. Haythornthwaite, to No. 11 F.T.S., Shawbury, 11.4.38. J. B. Gregor, to H.Q., Fighter Command, Stanmore, 11.4.38. P. H. Young, to R.A.F. Station, Manston; for duty as M.O., 14.4.38. T. J. Thomas, to No. 8 F.T.S., Montrose; for duty as M.O., 14.4.38. G. H. H. Maxwell, to H.Q., Coastal Command, Lee-on-the-Solent; for duty as Deputy Principal M.O. (Hygiene), 18.4.38. C. A. Lindup, to No. 6 F.T.S., Netheravon; for duty as M.O., 19.4.38.

Squadron Leader.—G. W. Paton, to Medical Training Depot, Halton, 11.4.38.

Dental Branch

Flight Lieutenant.—O. F. Brown, to No. 9 F.T.S., Hullavington, 11.4.38.

Chaplains Branch

Rev. W. E. O'Neill, to No. 1 R.A.F. Depot, Uxbridge; for duty as Chaplain (C. of E.), 1.3.38.

Owing to the greatly increased length of these lists as a result of R.A.F. expansion, ranks are confined to those of Flight Lieutenant and above.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

THE BOOKING BAN

An Example of Fair Treatment

I NOTICE in the Commercial Aviation notes of your issue of April 21 you comment on the fact that the Railway Clearing House ban is still effective on the Penzance-Scilly Isles service of Olley Air Service.

In justification of the railways, I should like to say that when I recently applied to the G.W.R. for an informative brochure on the Scilly Isles, they gave me, in their accompanying letter, full details of this service, including such details as fares and reservation addresses. W. H. BEWG.

West Norwood, S.E.27.

HELICOPTER PROGRESS

"Is There Anything New Under the Sun"?

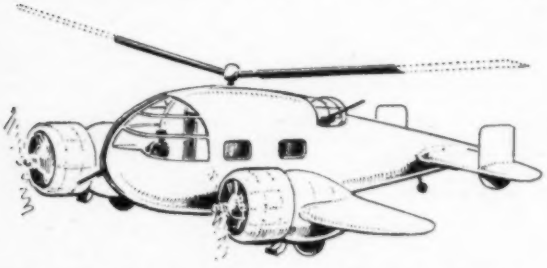
ALTHOUGH the new Focke-Wulf helicopter has put up some noteworthy performances, it is difficult, from the photographs published in *Flight* of April 21, to find anything original in regard to the essentials of this machine, i.e., the rotor heads, which to all intents and purposes are a copy of Cierva's rotor head. Apparently the only difference between the Focke-Wulf helicopter and the Cierva Autogiro exists in the fact that whereas only *part* of the engine's full horse-power is applied to Cierva's rotor, and is applied for starting-up the rotor only, the *full* horse-power of the motor is applied to the Focke-Wulf rotors and is applied continuously during the flight. If this change were effected in the Autogiro, rendering it a helicopter proper, there would then be no difference in principle, and little indeed in design, between the Cierva and the Focke-Wulf machines. The use of two rotors in place of one is a detail; its only use is to neutralise torque reaction.

In regard to the tilting of the rotors, used to obtain forward motion in both the Brèguet and Focke-Wulf helicopters, this idea is at least sixty years old, as an examination of the files in the Patent Office Library will disclose.

The placing of one rotor above another and running both in opposite directions to counteract torque reaction (*vide* Brèguet) is even older, as the same files will likewise disclose. Even the broad principle of Cierva's Autogiro (less, of course, its "articulations") was patented by the late Sir Hiram S. Maxim in 1891 or thereabouts.

To some of those who have been a quarter of a century or more in aircraft design the coming of the Autogiro and the helicopter are a portent foreshadowing great changes and perhaps the passing altogether of the fixed-wing aeroplane as we know it to-day. The fixed-wing aeroplane has its shortcomings in long take-off runs and high landing speeds, but once into the air and going well its speed, efficiency and pay-load capacity are greater than that of any Autogiro or helicopter ever likely to be designed. The Autogiro and helicopter have the advantage every time in quick or vertical take-off and in slow, vertical "parachutal" descent. Apparently what is required is an aircraft combining the functions of all three, i.e., that shall be a fixed-wing aeroplane in flight and an Autogiro or helicopter in take-off and landing. When we have that, then we shall be getting somewhere near the perfect aircraft visualised by such writers of scientific romance as Jules Verne and H. G. Wells. Judging by some patents taken out in Britain in the early years of this century by one Mr. G. L. O. Davidson (and some of the old-timers will remember that gentleman and his mysterious "Gyropter"), even *this* idea is over thirty years old. Consequently, the present-day aeronautical inventor may well ask despairingly, "*Is* there anything new under the sun?" E. V. HAMMOND.

London, S.W.



Perhaps this impression of the Cameron Rotor Plane meets Mr. Hammond's plea for an aircraft which combines the advantages of aeroplane, gyroplane and helicopter. Mr. Peter Cameron, of Glasgow, has patented a way of retracting the rotor blades during flight.

BROADSIDE FIRE

The Effect of Projectile Rotation

OF the Cazaux Effect I know nothing; nor can I envisage any "effect" modifying the direction of a bullet's normal trajectory other than transverse winds acting either directly upon the bullet or indirectly through the Magnus Effect.

The latter will have an influence at right angles (or approximately so) to the direction of the wind. A bullet fired with right-hand rifling (i.e., rotating, as viewed from behind, clockwise) broadside into a wind blowing from left to right will be deflected upwards owing to the increased pressure on the underside and the decreased pressure above. At modern wind velocities (e.g., 400 m.p.h., speaking, of course, relatively) this deflection may well be of a high order and correction would be a very difficult matter, bearing in mind that, firing from a rotating turret, the angle of incidence to the wind is constantly changing and that the influence of the effect is reversed from port to starboard.

If the Magnus Effect is shown to be a real obstacle to broadside fire it at once prompts the question: is rotation of the bullet necessary?

In the early days of the war "aerial darts" were kept steady in flight by having the tails of their pencil-shaped bodies milled out to leave four fins or feathers standing up to, but not beyond, the original diameter. A four-finned vane could, I should imagine, be anchored without difficulty in the lead core of the normal bullet without alteration to its size or shape.

The Magnus Effect now being inoperative, the effect of a cross wind upon such a non-rotating, tailed bullet would be to deflect the tail until the pressure upon it of the wind was balanced by the pressure upon it on the other side due to the "head-wind" it was now encountering. Such deflection would be extremely small, and the resulting drift into the wind, as far as one can judge without calculation, would be negligible and beneficial rather than otherwise.

If such a system were found adequate in practice two other advantages would accrue: the manufacture of gun-barrels would be somewhat cheapened and muzzle velocity increased by the amount of energy now converted into rotational movement. R. A. DENNE.

THE R.A.F. AT GLASGOW

THE Royal Air Force is prominently represented at the Empire Exhibition, Glasgow. When His Majesty the King opened Bellahouston Park last Tuesday morning a salute was given by a squadron of Avro Ansons flying overhead. During the period of the Exhibition R.A.F. machines will be co-operating with the Army in searchlight and sound location displays.

In the R.A.F. pavilion examples of modern scientific flying equipment are being shown, and these will be changed from time to time so that the public may see as many as possible of the present-day developments.

One of the most striking exhibits is a partly sectioned Hawker Hurricane, of which certain details may now be revealed, as will be seen from a paragraph on page 445.

A separate Hurricane instrument board with blind-flying instruments in position is being shown, and among other things guns, camera guns, radio, signalling apparatus, and oxygen equipment are displayed.

A dummy pilot is clothed in full flying kit, with electric heating.

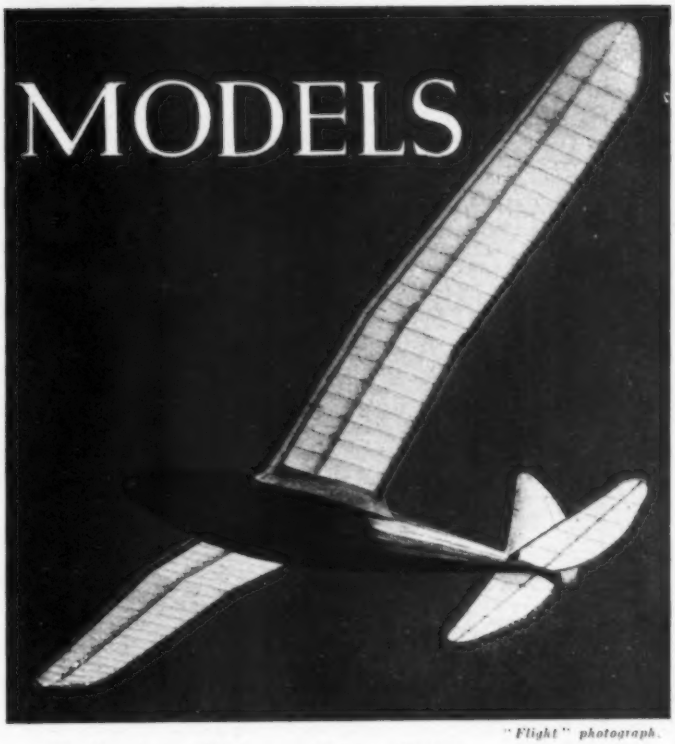
A large wall map in glass and wrought iron is flanked by a new life-size portrait of the King as Marshal of the Royal Air Force, and a portrait of the Queen.

Full particulars of life in the R.A.F. and the openings available for recruits of all ages are given at an information bureau.

Outsize enlargements of photographs taken specially by *Flight's* chief photographer, decorate the R.A.F. pavilion. Examples of these are to be seen in the photogravure supplement (pages 442c-442f) of this issue.

Incidentally, Vickers-Supermarine intend to display a complete aircraft on their stand. They hope to have a Spitfire single-seater fighter available for this purpose.

MODELS



"Flight" photograph.

The heading picture shows Mr. Copland's glider, described below.

Gull-wing Glider : Some Points on Design : Club Activities

By M. R. KNIGHT

A Successful Sailplane

PLEASING lines and proportions, perfect construction and fine performance stamp the "Starling" glider designed by Mr. R. Copland, of the Northern Heights Model Flying Club, as the work of an uncommonly gifted modellist. Built almost entirely of balsa, the weight is but 5¼ oz., despite the substantial blob of lead in the nose, and the 48 ribs!

The fuselage is of elliptical section, and consists of four longerons and 16 stringers of hard balsa, planked with 1/32in. sheet from the nose to the wing, the whole being covered with a double thickness of black tissue. Trim is secured by a weight sliding along a spar attached to the nosepiece, which is held in position by press studs. The length is 26in.

The wings have 240 sq. in of area, and are 52in. from tip to tip. A reduction of chord from 6in. to 4in. is effected by sweeping back the leading edge ⅝in., and sweeping forward the trailing edge 1⅜in. Each wing leaves the fuselage at an angle of 17 deg., which, at a distance of 8in., changes to 5 deg. Projecting hollow spars of balsa plug into fuselage sockets formed from ⅛in. balsa sheet. The R.A.F. 32 wing-section is obtained with ribs cut from 1/32in. sheet, and spaced 1in. apart. Shaped lengths of ⅜in. × ⅛in. balsa form the leading edge, the trailing edge is of ⅜in. × ⅛in., the tips of 1/16in. × 1/16in. birch, and the fillets of 1/32in. sheet. The wing setting is parallel with the datum-line.

A tailplane of streamline section, with an area of 50 sq. in., and 15in. in span, is mounted at 2 deg negative to the wing. The fin is 20 sq. in. in area, 5½in. high, and has a 3in. × 1in. trimming-tab. It serves to lock the tailplane into position by means of a hardwood peg and a press-stud. Wings and tail unit are covered with a single thickness of white tissue.

Launched by a 75ft. towline, the "Starling" has flown for 5½ min.

The Gamage Cup

THE S.M.A.E. 1938 competition season was ushered in by a boisterous wind, which in some localities made the flying of the Gamage Cup contest all but impossible. The winner was Mr. S. Pedersen (Wembley M.F.C.), with the remarkable average on three rise-of-ground flights of 231.6 sec. Mr. N. Blacklock, of the same club, averaged 150 sec. A replica of the elegant tapered high-wing model with which he retrieved the Wakefield Cup from America in 1936, won third place for Mr. A. A. Judge, of The Model Aircraft Club, with an average of 136.886 sec. Remarkable "stall-proof" 45 deg. climbs were achieved with a "tail-first" model by Mr. D. A. Paveley, of The Model Aircraft Club.

Lord Wakefield's Generosity

LORD WAKEFIELD has added yet another to his many benefactions to model flying by contributing £200 towards the cost of sending a British team to France to (we hope) retrieve the Wakefield Cup on July 31 next. The team will be chosen by eliminating trials at Fairey's Great West Aerodrome on July 3.

Wakefield Model Layouts

THE question of the most suitable layout for Wakefield class models is an intriguing one, and a brief survey of the pros and cons will probably interest many friends in full-scale aviation. The main problem is to find a line-up which will secure equally satisfactory power flight and glide, despite the absence of a pilot and the varying power output of the rubber motor. Good gliding characteristics are imperative in view of the brief motor run.

The parasol scores in respect of glide, but the low thrust-line is troublesome. A tailplane of lifting section helps, but the longitudinal adjustment tends to be critical. The wing attachment is apt to be troublesome under the rough-and-tumble conditions of pilotless flying.

The high-wing monoplane is extremely popular. The thrust-line cannot be placed as high as is desirable (in the region of the top longerons, where the rubber skein cannot function) without resorting to a gear, with the airscrew on an idling shaft. A perfect gear is needed to avoid power wastage. Nevertheless, this layout is very satisfactory.

The shoulder-wing model avoids the thrust-line difficulty, and is becoming popular, but the advantage can be lost through the greater complication of the wing attachment. This difficulty is accentuated in the mid-wing layout by the necessity of keeping the wing roots well away from the rubber motor. Gull-wing models tend to be sensitive longitudinally, and the bend in the wings is not easily contrived without weight increase.

The low-wing monoplane is neglected on account of alleged poor gliding characteristics, but in the writer's view this trouble (and most others) is due to top-heaviness and excessive dihedral, which could be rectified with greater experience. Even heavy-weight low-wings have achieved prolonged glides and been lost in thermals. The possibility of perfect thrust-line placing should be of immense value.

It appears to the writer that a good deal turns on the individual designer's experience with a particular type.

S.M.A.E. Fixtures in May

A CONTEST for gliders, catapult-launched, will be held on May 8. Best average of three flights wins the *Model Engineer* Cup No. 1. A seaplane contest for the Short Bros.' Cup will be flown on May 22, launching tanks being allowed. Both contests will be flown on the grounds of clubs affiliated to the S.M.A.E.

The speed contest for the *Flight* Cup will be held on May 29. Last year's winner, Mr. R. L. Rogers (Northern Heights M.F.C.) has ready a new version of his twin-fuselage low-wing model, and the previous holder, Mr. H. E. White, B.Sc. (Northern Heights M.F.C.), has constructed a low-wing model with co-axial airscrews. Information regarding the venue can be obtained from Mr. J. C. Smith, 1, Treen Avenue, London, S.W.13.

* * *

John Lane, The Bodley Head, have issued at 12s. 6d. a new version of *The Complete Model Aircraft Manual*, by Edwin T. Hamilton. British readers will doubtless regret the space devoted to spar models, but the book contains a wealth of useful information on materials, methods of wing and fuselage construction, wing covering, gliders, "solids"—to mention but a few of the subjects—copiously illustrated by really informative sketches. The plans of flying scale models now include the Battle and Lysander.

HERE and THERE

The New Expansion Committee

LAST Friday the Air Ministry announced the appointment of an inter-departmental committee to deal with the new R.A.F. expansion scheme. Chairman of the committee is Lord Winterton, Deputy to the Air Minister, and members of the committee are: Air Marshal Sir Wilfrid R. Freeman, Air Member for Research and Development; Air Vice-Marshal W. L. Welsh, Air Member for Supply and Organisation; Air Vice-Marshal R. E. C. Peirse, Deputy Chief of the Air Staff and Director of Operations and Intelligence; Mr. A. H. Self, Second Deputy Under-Secretary of State; Sir Charles Bruce-Gardner, chairman of the S.B.A.C.; and Mr. E. E. Bridges, of the Treasury. Secretary of the committee is Mr. H. Russell.

Alvis Advances

THE new 11¾-litre Alvis nine-cylinder radial is to be called the Leonides. Although there is very little general resemblance between this engine and the two-row Maeonides, the heads and valves are practically interchangeable, the bore being the same. The stroke of the Leonides is a little shorter.

Four of these engines are being made. The first has completed over 20 hours' successful running on the beds, and power figures of well over 400 h.p. have been obtained. The design is more simple than the other Alvis models.

Sets of components for Maeonides are on the way, and two 18-cylinder Alcides are ready for assembly. The 14-cylinder 1,000-h.p. Pelides was type-tested a few months back.

Pobjoy Appointments

SOME important appointments to the board of Pobjoy Air-motors and Aircraft, Ltd., are announced. Mr. Oswald Short has been elected chairman and Mr. Arthur Gouge managing director. Mr. P. H. Cozens has become a new director.

In succession to Mr. D. R. Pobjoy, who severed his connection with the company a few weeks ago, Mr. C. O. Towler has been engaged. Mr. Towler was responsible for the design of Wolseley engines under Lord Nuffield. He is to carry out exhaustive tests on the Niagara V engine and to improve its accessibility and ease of maintenance. This development work, it is stated, will be so extensive that the improved engine will not appear on the market for some little time.

More About the Empire Exhibition

AMONG the exhibits at the Empire Exhibition, Glasgow, and in addition to those noted in these columns last week, may be noted several more of interest to the aeronautical industry.

For instance, a Supermarine Spitfire will, it is hoped, appear on the stand of the Vickers group in the Palace of Engineering, while in the armaments section of the same exhibit are a 75 mm. anti-aircraft gun and a Vickers predictor.

Another section of the Vickers display is occupied by the products of the English Steel Corporation, and includes a full-sized model of a 230-ton steel ingot, the largest forged, entering a furnace. Smaller E.S.C. exhibits include precision-ground bars and the steel tools for which the company is so well known. A Vickers projection microscope is shown by Cooke, Troughton and Sims.

Most appropriately, for it has four extensive works in Scotland, the British Aluminium Co., Ltd., stages two large exhibits, one showing the many applications of aluminium in industry and the other illustrating the forms in which the metal and its alloys are produced in the works. Among working exhibits are demonstrations of the turning of the company's free-cutting alloy BA/35 and the spinning of pure aluminium.

One of the largest and most impressive buildings belonging to a single concern is the pavilion of Scottish Oils and Shell-Mex, Ltd., and its parent companies, The Anglo-Iranian Oil Co. and the Shell Transport and Trading Co. It has been designed to show the importance of petroleum products in all branches of industry and commerce throughout the world. Films are shown in a cinema, and an exhibition hall contains a number of working exhibits, including the Smith wear and lubricant tester. This machine is used to determine quickly the best metal and the best lubricant to use for any specific purpose in machine construction. The new Shell lubricating oils are seen under test.

The Esso pavilion, on the approach to the Amusement Park, is a "symphony" in glass, bearing on its four sides a set of four illuminated glass plaques symbolising those qualities which have contributed to the company's half a century of achievement. A spacious hall inside displays three models depicting the many uses of Esso products on land, sea and in the air.

"Ex-apps" Reunite at Farnborough

FIFTY-THREE "Ex-apps" were present at the first reunion of the Royal Aircraft Establishment Ex-apprentices Association, held recently at Farnborough.

After a tour of the Establishment in the afternoon there was a dinner at the Queen's Hotel, and it afforded everybody the opportunity to recall happy times to as far back, in some cases, as 1918. The chairman and organiser was Mr. J. F. Gunn, headmaster of the Apprentices' School, supported by Dr. Harris and Mr. G. T. H. Cook, masters.

The visitors were Mr. A. H. Hall (chief superintendent, R.A.E.), Mr. W. Piper (production manager of Saunders-Roe), and Mr. W. F. Prochl, headmaster of Vickers (Aviation), Ltd., Apprentices' School.

Toasts of "The Association" and "The Visitors" were proposed by Mr. Cook and Mr. Oliver respectively, and the responses by Mr. Gunn and Mr. A. H. Hall, whose speech was particularly appreciated. Mr. Prochl spoke enthusiastically of the boys in his time at the R.A.E.

It was a happy and successful start of an annual reunion, for which a much increased attendance is predicted next year. Mr. Gunn would be glad to hear from any "Ex-apps" with whom he has not been in touch.

NEW COMPANIES

In the notes below, for reasons of space, the "objects" of new companies are usually somewhat abbreviated.

TRAVELAIR LTD.—Private company, registered April 25. Capital £100 in 100 ordinary shares of £1 each. Objects: to carry on the business of a travel and excursion agency by air, land and sea, tourist agency, etc. The directors are: Kenelm A. P. Dalby, and Norman Brett. Registered office: 38, Avenue Chambers, Vernon Place, London, W.C.1.

WESTERN AIRPORT LTD., was registered as a private company on April 6, with a nominal capital of £5,000 in 5,000 shares of £1 each. The objects are to carry on the business of proprietors and managers of airports or aerodromes, etc. The first directors are Whitney W. Straight (chairman) and others to be appointed by the subscribers. Solicitors: McKenna & Co., 31-4, Basinghall Street, London, E.C.2.

PUBLICITY PLANES, LTD.—Private company, registered April 7. Capital £5,000 in 5,000 shares of £1 each. Objects: to carry on the business of aerial advertising contractors and agents, etc. The directors are: Wm. R. L. Beaumont, Leslie Woollard, Jas. D. Willis. Registered office: 11, Queen Victoria Street, London, E.C.4.

CODE PRESSINGS LTD.—Private company, registered April 5. Capital, £1,000 in 1,000 ordinary shares of £1 each. Objects: to carry on the business of engineers, founders, smiths, machinists manufacturers and patentees etc. The first directors are to be appointed by the subscribers. Registered office: 119, Charles Henry Street, Birmingham.

COMMERCIAL AIRMEN LTD.—Private company, registered April 22. Capital, £100 in 100 shares of £1 each. Objects: to carry on the business of commercial airmen, air pilots, advertising agents, photographers, etc. The directors are: Anthony G. Humble-Smith (director of F. W. Barratt & Co. Ltd.), Leslie R. Little. Registered office: 100, Charing Cross Road, London, W.C.2.

AVIATION ENGINEERING (MESSIER) CO.—Registered as a private company on April 21, with a nominal capital of £10,000 in 10,000 shares of £1 each. The objects are to carry on the business of manufacturers, repairers, letters on hire or hire-purchase, exporters and importers of and dealers in all kinds of gas, oil, electrical and mechanical equipment for starting engines, motors or machinery. The number of directors is not to be less than two nor more than five. Two are to be nominated by Aeronautical and Mechanical Inventions, Ltd., and three by Petters, Ltd. Registered office: Westland Works, Yeovil, Somerset.

AERONAUTICAL PATENT SPECIFICATIONS

(The numbers in brackets are those under which the Specifications will be printed and abridged, etc.):

19276. BENDIX AVIATION CORPORATION: Brakes (481,665).
25321. BENDIX AVIATION CORPORATION: Brake control mechanism for aircraft (481,804).
25580. BENDIX, LTD., and ROBERTS, G. P.: Control of aircraft brakes (481,946).
26083. BENDIX AVIATION CORPORATION: Universal joints (481,812).
32201. CONTRAVES AKT.-GES.: Method for measuring photogrametrically the aiming and firing error in firing exercises against moving targets, more especially aircraft, and apparatus for carrying out the method (481,820).
10071. SERVO-FREIN DEWANDRE SOC. ANON., and FUSCALDO, O.: Liquid fuel injection systems for internal-combustion engines (481,786).
17014. JUNKERS FLUGZEUG-UND-MOTORENWERKE AKT.-GES.: Mounting and sighting guns on aircraft and other vehicles (481,649).
17218. SPERRY GYROSCOPE CO., INC.: Electrical control systems (482,189).
17338. KAESS, L. L.: Radio direction-finding (481,961).
25826. WILLOUGHBY, P. N.: Airscrews (482,334).
25962. BRISTOL AEROPLANE CO., LTD., FEDDEN, A. H. R., OWNER, F. M., and COPLEY, J. W.: Aeroplane wings (482,135).
26421. SPERRY GYROSCOPE CO., INC.: Gyroscopic compasses (482,215).
29806. BRISTOL AEROPLANE CO., LTD., FEDDEN, A. H. R., and OWNER, F. M.: Installation of supercharged internal-combustion engines in aircraft structures (482,151).
30971. HAVILLAND, H. DE, and DE HAVILLAND AIRCRAFT CO., LTD.: Actuation of suction-driven or pressure-driven apparatus by internal combustion engines (481,986).
32122. ARMSTRONG WHITWORTH AIRCRAFT LTD., SIR W. G., and LLOYD, J.: Take-off of aircraft (482,057).
33281 DUNLOP RUBBER CO., LTD., BEHARREL, G. E., WRIGHT, J., and TREVASKIS, H.: Fluid pressure brakes and steering controls for aircraft (481,997).
35432. BURGESS, E., and AEROGRAPH CO., LTD.: Spraying apparatus (482,003).
812. PLESMAN, A.: Method of and means for launching and landing aircraft (482,160).
4514. BARKLEY, A. ST. C.: Aeroplane wing structure (482,166).
13570. MERCIER, P. E.: Aircraft control systems (482,080).
20320. JUNKERS FLUGZEUG-UND MOTORENWERKE AKT.-GES.: Cylinders of internal-combustion engines (482,099).